CUSTOMS UNIONS:

THEORY AND ESTIMATION

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ABSTRACT

[i] General Equilibrium Theory

World excess demand functions for two goods may be written as a function of their relative price in one country and the tariff rates of the three countries. The condition for dynamic stability allows one to unambiguously determine the direction of the change in that price in the normal case on the formation of a customs union. New and conclusive results on trade diversion versus trade creation, the terms of trade, and welfare are then obtained.

Subsequently the customs union facing fixed terms of

trade is examined. A new condition on Trade Indifference surfaces is derived as a consequence of the restrictions necessary on individual utility functions for community indifference curves to exist. This information provides new and simple results for the small two member union which are generalised to small unions with an arbitrary number of members for tariff adjustments of any magnitude.

It is proved that the composite goods theorem holds under distortions and may be applied to the many good small customs union. With many goods thereby reduced to two the results of the previous paragraph apply.

[ii] Estimation

A general equilibrium model of the effect of tariff changes upon national income at factor cost is set up and estimated. Forecasts are made of the effects of a modification to NAFTA should New Zealand eliminate tariffs on certain Australian goods. Subject to error a small increase in income generated in the NZ manufacturing sector is predicted. It is concluded that the protectionists' case is not sustained and that NZ could adopt an across the board approach to renegotiations of NAFTA instead of tariff by tariff procedures.

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INTRODUCTION

Customs Unions have their attraction for their theoretical interest and for their practical importance. The regularity introduced to countries tariff schedules by those discriminatory tariff agreements intrigues the theorist because the additional information may allow him to overcome the difficulties that usually arise in problems involving the theory of the second best. In the real world it is a question of some moment whether a country should enter a free trade area or whether it should not. The econometrician in this case is faced with a problem of significance, first in improving on the estimating models of other workers and second in finding a method of estimation which does justice to the model he has developed. The writer has been drawn to Customs Unions for these reasons and the present piece treats both their empirical and their theoretical aspects.

The large and widely scattered literature on customs unions is not surveyed in this study. Instead a careful comparison of results is presented where one of the topics studied bears on the work of a theorist in the field. A general equilibrium analysis is pursued with perhaps greater mathematical rigour than has been customary in the field. A consequence of the general equilibrium framework combined with the criterion applied to the literature is that the insights into the problem gained by the investigators of partial equilibrium models have been by-passed. The other cut through the literature has been made at Lipsey's work. Research prior to Lipsey's book and his survey has been excluded. James Meade & Harry G. Johnson, who were the first important workers in the field subsequent to Viner, made notable advances which are not acknowledged in this study because of the Lipsey cut. In any case their work is implicit since it underpins Lipsey's who, in retrospect, did not progress far past them. The approach just described to the literature selects for particular attention the results reported in the books by Lipsey, by Vanek and by Kemp who are the second wave theorists, making a general equilibrium attack on the customs union problem. Perspective may be gained, and an overview obtained, if the innovative aspects of the present piece are listed. Each chapter displays one innovation. It occurred to the writer that though Lipsey, Vanek & Kemp were working with stable models they had not made use of stability conditions. By using the usual dynamic assumptions Chapter I succeeds in finally ironing out several important, but previously clouded, issues on which the three writers are at variance between each other in the large customs union problem. The key idea in Chapter II is one which appears to have escaped notice in many areas of trade theory where community indifference curves are involved. If community indifference curves are to exist a restriction is implied on individual utility functions. The nature of the restriction is such as to preclude inferior goods and with that imbroglio cleared away results become unambiguous and simple for the small customs union. Chapter III deals with the small customs union trading many commodities. There has not been a great deal of work done on this problem which is made the more complex by the pairwise substitution and complementarity relationships between three or more goods. The thought exploited in Chapter III is that the pairwise problem may be solved by introducing the composite goods theorem in such a way as to convert the system into a two good model of a small customs union. Simple results are then obtained. The object of the final chapter is to present a general equilibrium model of the change in national income at factor prices which may result from a customs union and then to forecast the effect on factor incomes in the New Zealand manufacturing sector when the New Zealand-Australia Free Trade Agreement is modified. Recognition that a tariff change affects the equilibrium price and the quantity supplied of a factor is the central idea here and a simultaneous equation approach to the estimation of the general equilibrium factor supplies and factor prices is adopted, from which a prediction on changes in factor incomes is made. Subject to the forecast's error the outcome is of significance in the New Zealand debate on protection. A problem should be mentioned here in that the theoretical difficulties of the distribution of the tariff revenue, faced and resolved in Chapters I, II, III - the theoretical parts of the study - are ignored in the empirical chapter. The reason why this problem has been left untouched is that in the real world the rules by which factors are affected by the distribution of the tariff proceeds are unknown.

CHAPTER 1

THE STANDARD THEORY OF CUSTOMS UNIONS

The work of Kemp (9), Negishi (15) and Vanek (20) has carried the theory of economic integration forward since Lipsey (11) surveyed the field in 1960. Inter-country groupings have increased in number since that time and each grouping has brought to light new problems which many writers have examined; an important branch of the literature of the 1960's is devoted to the special features of trading arrangements between economies which are poor. Despite the attention the topic has received, results are still a morass of special cases.

Particularly noticeable in customs union theory is the way successive authors have relied upon, corrected - and extended - the results of their predecessors. The line of succession from Viner (22) and Meade (15), via Lipsey (12) through to Vanek (21) and Kemp (9) clearly illustrates the process. Further corrections, simplifications - and extensions - are presented in this study. One extension is the explicit introduction of stability conditions which inject hitherto dormant information, thereby correcting earlier results and providing new ones. Modifications of earlier results on welfare, on the terms of trade and on the trade creating and trade diverting unions will be noted; the distinction between these last two, it turns out, is not required for the terms of trade problem.

Negishi's paper (16) probes the Paretian conditions to reveal the optimal relations between partners' consumption taxes, subsidies and tariffs, though Takayama (20, p.471-472) has described Negishi's "piecemeal approach" to the theory of second best as being handled, "in a rather subtle way so that the real significance of this point is not too clear from his discussion". Principle emphasis in Vanek is on the terms of trade problem while Kemp's orientation is towards welfare changes. Both writers recognise that the two matters are related and the interrelation is intensified here.

Vanek and Kemp derive results through graphical techniques requiring, and in this respect they are similar to Negishi, community indifference curves. An advantage the diagrammatic approach has over the calculus is that it accommodates discrete changes in tariffs while the calculus does not. Inferior goods constitute a major problem in stating graphically derived results, even in the two commodity case. Although non-graphical methods of course do not eliminate inferior goods, these goods can be more easily accommodated and results more simply stated, with algebraic methods. The usual requirement of no inferior goods is not a necessary assumption for some results, it will be shown, though Giffen goods will be proscribed for the world economy as a whole.

One reason for adhering to the two-good-three-country case, a reason perhaps deeper than the convenient two dimensions of a diagram, is that only one pattern of trade is then admissable on the formation of a trading arrangement between two countries against a third, in the absence of public distortions. The only permitted pattern of trade is that one partner is isolated from the third country. To exploit this convenience and to preserve comparability with much of the literature cited, only two goods and three countries will be allowed in the model to be developed.

Domestic Prices

Membership of a customs union has real effects on an economy stemming, largely, from the induced changes in domestic prices. Knowledge of the changes in domestic prices is thus a pre-requisite for analyzing many of these real effects, and accordingly, the standard model of customs unions is set out here and examined for its content on directional variations in local prices. Work prior to the present piece has not succeeded in determining what happens to domestic prices.

One member of the union is isolated from non-union countries in the standard model of customs unions (9, 12, 15, 20). This country will be A which exports good 1 to and imports good 0 from Country B. Non-member C then exports good 1 to and imports good 0 from B. A consequence of this highly specific pattern of trade in the standard model is that that the excess demand functions for each country take the particular forms [(1)]

$$F_i^a = F_i^a(P^a, t_{ab}) \qquad (1)$$

(1) These relations are derived in the appendix.

$$F_i^b = F_i^b(P^b, t_{ab}, t_{ba}, t_{bc}, t_{cb}) \qquad i=0,1 \tag{2}$$

$$F_i^c = F_i^c(P^c, t_{cb}) \tag{3}$$

where F_i^V is country V's excess demand for good i, P^V is the relative price of good 1 in Country V, (V=a,b,c) and t_{vr} is Country V's ad valorem tariff on imports from country r. Tariff links (2) between prices are present in the model,

$$\begin{aligned} P^b &= (1+t_{ab})(1+t_{ba})P^a \\ &= (1+t_{bc})(1+t_{cb})P^c \end{aligned} \tag{4}$$

and may be substituted into equations (1), (3) in order to obtain the world equilibrium excess demands, F_i, in terms of P^b and the tariffs; the procedure is

$$F_i^a\ (P^a, t_{ab}) + F_i^b\ (P^b, t_{ab}, t_{ba}, t_{bc}, t_{cb}) + F_i^c\ (P^c, t_{cb})$$

$$= F_i^a\ \left(\frac{P^b}{(1+t_{ab})(1+t_{ba})},\quad t_{ab}\right) + F_i^b\ (P^b, t_{ab}, t_{ba}, t_{bc}, t_{cb})$$

$$+ F_i^c\ \left(\frac{P^b}{(1+t_{bc})(1+t_{cb})},\quad t_{cb}\right)$$

$$= F_i(P^b, t_{ab}, t_{ba}, t_{bc}, t_{cb}) \qquad i=0,1$$

$$= 0 \tag{5}$$

Under assumptions which are not stringent, involving the stability of the system and allowing inferior goods (negative income effects) in up to two countries, definitive signs of price changes upon the formation of a customs union can be obtained from system (5).

Introducing, at this point, the standard dynamic assumption of price formation,

$$\dot{P}^b = g[F_1(P^b, t_{ab}, t_{ba}, t_{bc}, t_{cb})]$$

and the Routh-Hurwitz conditions for stability, which degenerate to

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(2) These relations are derived in the appendix

$$\frac{\partial F_1}{\partial P^b} = \frac{f_1^a}{(1+t_{ab})(1+t_{ba})} + f_1^b + \frac{f_1^c}{(1+t_{bc})(1+t_{cb})}$$

$$< 0 \tag{6}$$

where $f_1^v = \dfrac{\partial F_1^v}{\partial P^v}$, $v=a,b,c$

and noticing that the total derivative of the world excess demand for good 1 from equation (5) is,

$$dF_1 = f_1^a dP^a + f_1^b dP^b + f_1^c dP^c + (h_{1ab}^a + h_{1ab}^b) dt_{ab} + h_{1ba}^b dt_{ba}$$

$$= 0 \tag{7}$$

since $dt_{bc}=dt_{cb}=0$ by the nature of a customs union agreement and

$h_{1vr}^v = \dfrac{\partial F_1^v}{\partial t_{vr}}$, it is then seen that the right hand side of (7) may be expressed in terms of the tariff changes and dP^b. The procedure is to use equation (4) to obtain

$$dP^a = \frac{dP^b}{(1+t_{ab})(1+t_{ba})} - \frac{P^b\left[dt_{ba}(1+t_{ab}) + dt_{ab}(1+t_{ba})\right]}{\left[(1+t_{ab})(1+t_{ba})\right]^2}$$

and (8)

$$dP^c = \frac{dP^b}{(1+t_{bc})(1+t_{cb})} \tag{9}$$

as $dt_{bc}=dt_{cb}=0$. Substituting equations (8) and (9) into equation (7) and solving for dP^b one obtains the effect the customs union has on Country B's prices,

$$dP^b = \frac{\dfrac{f_1^a P^b \; (1+t_{ab})dt_{ba} + (1+t_{ba})dt_{ab}}{[(1+t_{ab})(1+t_{ba})]^2}}{\dfrac{f_1^a}{(1+t_{ab})(1+t_{ba})} + f_1^b \dfrac{f_1^c}{(1+t_{bc})(1+t_{cb})}} - \frac{(h_{1ab}^a + h_{1ab}^b)dt_{ab} - h_{1ba}^b dt_{ba}}{\dfrac{f_1^a}{(1+t_{ab})(1+t_{ba})} + f_1^b + \dfrac{f_1^c}{(1+t_{bc})(1+t_{cb})}} \tag{10}$$

$$< 0$$

The sign of relation (10) follows from; (i) a negative denominator given by stability condition (6), (ii) $f_1^a<0$ on the assumption that excess demand in Country A responds normally to price, (iii) $dt_{ab}, dt_{ba}<0$ since Countries A and B reciprocally reduce tariffs, (iv) the income type effects $h_{1ab}^a, h_{1ab}^b, h_{1ba}^b>0$, as shown in the appendix to this chapter. Two of the income effects in the f_1^v or h_{1vr}^v terms could be negative if they were offset by others.

In Country C the price of good 1 also falls; from (9) and (10)

$$dP^c = \frac{dP^b}{(1+t_{bc})(1+t_{cb})} < 0 \qquad (11)$$

Price in Country A rises because, using equation (1),

$$dF_0^a = f_0^a dP^a + h_{0ab}^a dt_{ab} > 0 \qquad (12)$$

The positive sign of (12) is proved later in inequality (17); in addition we have $dt_{ab}<0$ as result of union, $h_{0ab}^a>0$ from the appendix and $f_0^a>0$ since goods 0 and 1 are substitutes. Therefore, by the signs of (12) and of its components

$$dP^a>0$$

A trading arrangement may be of the form where inter-member tariffs are dis-similar, the effect being to grant preferences to members while non-member countries are exposed to a different degree of discrimination. An example; $t_{bc}>t_{ba}>t_{ab}>t_{cb} \geq 0$; is the type of discriminatory tariff pattern operated under the British Imperial Preference Scheme, where countries B & A are interpreted as the U.K. & the "inner" Empire. Provided the tariff reductions in systems of this type are of a magnitude permitted by the usual methods of comparative statics adopted here the analysis yields a simpliste interpretation of the effects of such highly discriminatory agreements. A different type of customs union provides most favoured nation treatment to outsiders and provides a complete preference for members, e.g. $t_{bc} > t_{ab} = t_{ba} = 0$, a rearrangement of tariffs which is likely to involve finite movements and likely to pose interpretative difficulties for the comparative statics approach. As long as well behaved functions are assumed throughout relation (10) holds for every initial level of tariffs so that results are preserved for the discrete case by viewing it as a series of small reductions in members' tariffs.

In summary, it has been demonstrated that in the member country isolated from the rest of the world the domestic price of the exportable rises upon union. However in Country C, outside the union, the domestic price of the export good falls. Union member B experiences a fall in the local price of its imported good. These changes in domestic prices have been established directly and the firmer conclusions were obtained because the indeterminacies, associated with the customary approaches through terms of trade changes or trade creation and trade diversion, have been bypassed. Their significance lies in the resolution of two pressures; the downward pressure tariff concessions have on the domestic price of members' different imports and the upward pressure on members' prices of tariff discrimination against the outsider.

Heckscher-Ohlin Effects

One of the results of the Heckscher-Ohlin model is that a unique relation exists between product prices and factor rewards. The unique relation can be coupled with the results just obtained on the price effects of customs unions. When the price of a product rises the price of the factor used intensively in its manufacture increases as a consequence of constant returns to scale and of no factor reversals in the H-O Model. The domestic price of good 1 has been shown normally to increase after union for member A and the price of the factor intense there in industry 1, say labour, accordingly rises. But since P^b, P^c fall the real wage in Countries B and C declines. On Heckscher-Ohlin assumptions labour's absolute and relative income rises in the member country trading only within the Union and falls in the other Union country and in the rest of the world.

Terms of Trade

Changes in the Union's terms of trade with the rest of the world may be specified by recalling a definition. The Union's terms of trade is the world relative price of its export good; the ratio of quantities traded with the rest of the world, i.e.

$$\rho = -\frac{F_1^c}{F_0^c}$$

Since t_{cb} is constant under the agreement,

$$d\rho = \frac{[F_1^c f_0^c - F_0^c f_1^c] dP^c}{(F_0^c)^2} \tag{13}$$

where $f_i^C = \frac{\partial F_i^C}{\partial P^C}$. Complexities from inferiority set to one side, where they are usually placed, the necessary and sufficient condition for the Union's terms of trade to improve is pleasantly simple; when converted to elasticity terms. It has just been shown that $dP^C < 0$ for the normal case so a necessary and sufficient condition, in the normal case, for the Union's terms of trade to improve is that the bracketed term in the numerator of (13) takes a negative value. Introduce the elasticities of demand for imports and supply of exports (3), respectively η^C and ε^C, and the condition from (13) becomes

$$[F_1^C f_0^C - F_0^C f_1^C] = -\frac{F_1^C F_0^C}{P^C}[\eta^C + \varepsilon^C] \qquad (14)$$

$$< 0$$

Country C exports good 1 so $F_1^C < 0$, $F_0^C > 0$. The inequality in (14) requires

$$\eta^C + \varepsilon^C < 0.$$

This necessary and sufficient condition does, in fact, apply because it is a widely known property of the elasticities in international trade theory that

$$\eta^C + \varepsilon^C = -1.$$

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(3)
$$\eta^C \equiv \frac{\partial F_0^C}{\partial \frac{1}{P^C}} \frac{\frac{1}{P^C}}{F_0^C} = -\frac{f_0^C}{F_0^C} P^C$$

$$\varepsilon^C \equiv \frac{\partial F_1^C}{\partial P^C} \frac{P^C}{F_1^C} = \frac{f_1^C}{F_0^C} P^C$$

The result, new to the literature as are those on domestic price changes, is that the terms of trade normally move in favour of the union.

Trade Creation and Trade Diversion

Since Viner's work, discussion has centred round the effect the Customs Union has on trade with the rest of the world. Welfare results depend on whether the Union creates trade with the rest of the world or whether trade is diverted. Kemp (9, p.31) and Vanek (21, p.32-33) have discarded Viner's relative cost concept of trade creation and trade diversion in favour of a definition based on changes in the quantities traded with the rest of the world. Using expressions (3) and (11) we find, in the normal case,

$$dF_0^c = f_0^c dP^c < 0$$

and

$$dF_1^c = f_1^c dP^c > 0 \tag{15}$$

Inequalities (15) show that the rest of the world's imports from the Union shrink as do the rest of the world's exports to the Union (F_1^c is negative). A general contraction in trade with the rest of the world occurs; there is trade diversion in the normal case, in support of Viner's surmise (22, p.31) and contrary to Vanek's result (21, p.212) that one outcome is no more likely than any other. Trade within the Union, it is easily seen, expands in the normal case. From (1), (10), with

$$f_0^b = \frac{\partial F_0^b}{\partial p^b}, \quad h_{0vr}^b = \frac{\partial F_0^b}{\partial t_{vr}},$$

$$dF_0^b = f_0^b dP^b + h_{0ab}^b dt_{ab} + h_{0ba}^b dt_{ba}$$
$$< 0 \qquad (16)$$

and world equilibrium in the market for good 0 requires that

$$dF_0^a + dF_0^b + dF_0^c = 0.$$

Incorporating the signs from (15) and (16) we have,

$$dF_0^a = -(dF_0^b + dF_0^c)$$
$$> 0 \qquad (17)$$

or, there is an expansion in member A's imports after union. Turning to the movement in Country A's exports, utilising the positive value for dP^a established as a consequence of inequality (12), equation (1) yields

$$dF_1^a = f_1^a dP^a + h_{1ab}^a dt_{ab}$$
$$< 0 \qquad (18)$$

implying that member A's exports expand. Country A, it will be recalled trades only inside the union and because A's imports and exports both increase there is an expansion of trade within the union.

Member's Welfare

Kemp (9, p.32-33) is carefully agnostic in his treatment of the normal case; he finds that the Union's terms of trade may improve or deteriorate depending on whether, at constant world prices, there is trade creation or trade diversion. Welfare results on the distribution of gains and losses from union are equivalently indefinite since they too depend on the presence of trade creation or diversion, at initial world prices.

Vacillation over trade creation and trade diversion at initial prices has its root in the inherent limitations of the graphical methods and ought to be eliminated by an algebraic approach. We must determine whether there is trade diversion or trade creation at constant world prices. By relations (4) the connections between world price, P^c, and prices within the union are

$$P^a = \frac{(1+t_{bc})\ (1+t_{cb})P^c}{(1+t_{ab})\ (1+t_{ba})} = \frac{\tau P^c}{(1+t_{ab})(1+t_{ba})} \tag{19}$$

and

$$P^b = \tau P^c$$

Express each member's excess demand in terms of the world price by substituting from (19) into (1), (2). After the substitutions the union excess demand in terms of the world price is

$$F_1^u = F_1^a\left[\frac{\tau P^c}{(1+t_{ab})(1+t_{ba})}, t_{ab}\right] + F_1^b\left[\tau P^c, t_{ab}, t_{ba}, t_{bc}, t_{cb}\right]$$

and the union excess demand changes by

$$dF_1^u = \left(\frac{\partial F_1^a}{\partial P^c} + \frac{\partial F_1^b}{\partial P^c}\right)_{t_{ab}, t_{ba}} dP^c + \left(\frac{\partial F_1^a}{\partial t_{ab}} + \frac{\partial F_1^b}{\partial t_{ab}}\right)_{P^c, t_{ba}} dt_{ab}$$

$$+\left(\frac{\partial F_1^a}{\partial t_{ba}} + \frac{\partial F_1^b}{\partial t_{ba}}\right)_{P^c, t_{ab}} dt_{ba}$$

$$= \left(\frac{\partial F_1^a}{\partial P^c} + \frac{\partial F_1^b}{\partial P^c}\right) dP^c + \left(h_{1ab}^a + h_{1ab}^b - \frac{f_1 P^a}{1+t_{ab}}\right) dt_{ab}$$

$$+ \left(h_{1ba}^b - \frac{f_1^a P^a}{1+t_{ba}}\right) dt_{ba} \tag{20}$$

after applying the composite function rule. Our interest is in the excess demand at fixed world prices after tariffs decline i.e. the situation where $dP^c = 0$, $dt_{ab}, dt_{ba} < 0$

$$\therefore \quad dF_1^u = \left(h_{1ab}^a + h_{1ab}^b - \frac{f_1^a p^a}{1+t_{ab}} \right) dt_{ab} + \left(h_{1ba}^b - \frac{f_1^a p^a}{1+t_{ba}} \right) dt_{ba}$$

$$< 0 \qquad (21)$$

Hence at constant world prices the union's excess demand for its import is reduced by the tariff change; there is trade diversion.

The upshot of this is to relieve the standard model of customs unions of its abmivalence over trade creation, or trade diversion, at both initial and final prices. There is trade diversion at both price sets - see inequalities (15) and (21) - and this is a refinement of Vanek's position. It is also a refinement and clarification of Kemp (9, p.32-33) who was unable to isolate trade diversion from trade creation at constant prices. A gain has been achieved in simplicity by closing off the possibility of trade creation. Of greater value than this is the coherence brought to Kemp's welfare conclusions. He showed (9, p.35) that with trade creation one member necessarily suffers. Eliminating trade creation eliminates the necessity that the welfare of one member falls.

Kemp showed that,

> "Strong inferiority aside, the exchange of trade preferences by A & B may result in either the creation of trade or the diversion of their joint trade with the rest of the world. At least one member must benefit from club membership. If the

exchange of preferences results in trade creation, that member which trades only within the club must benefit, the other member must suffer. If the exchange of preference results in trade diversion, either member or both may benefit."

(9, p.34-35)

The result is now more definite and reduces essentially to Kemp's last sentence:

" ... the exchange of trade preference results in trade diversion, either member or both may benefit."

Had he fully summarized the welfare results he obtained Kemp would have mentioned that one member may, but need not, suffer (9, p.34).

Conclusion

Four of the issues at the centre of customs union theory have been taken up. These issues are (i) the effects union has on the domestic prices in three countries, (ii) the variations in the Union's terms of trade, (iii) the extent to which trade is created or trade is diverted, (iv) members' welfare. Writing the excess demand functions in each country as dependent on the domestic price in Country B is the analytical twist which has extended existing results. The results on the four issues, obtained for the normal case, are (i) the domestic price of A's exportable rises in member A, falls in member B and falls in the rest of the world; (ii) the union's terms of trade improve, so those of the rest of the world deteriorate; (iii) trade is diverted from the rest of the world at initial prices and at final prices; (iv) the elimination of trade creation has eliminated the necessity of a decline in one member's welfare.

APPENDIX TO CHAPTER I

Excess Demand Functions

Shoven (19) has recently proved the existence of equilibrium using excess demand functions in a world characterized by variable supplies, by many governments and by multiple tariff rates. His treatment is general and includes the excess demand functions used in the text for the customs union members and for the rest of the world. Certain variables do not enter those excess demand functions for some countries, in the customs union problem under consideration, and a derivation is provided. For the assumptions necessary to ensure the existence of, and the continuity of, the excess demand functions as well as other technical requirements the reader is referred to Shoven. Since the methods of infinitestimal calculus are used here the further restrictions necessary to distinguish between local and global maxima are assumed to apply. The derivations which follow are for an exchange economy, though the text treats the variable supply problem; variable production may be incorporated in the usual general equilibrium manner of Shoven.

Consumer j in Country A maximises

$$L = U_j(x_{0j}, x_{1j}) + \lambda[P_0^a x_{0j} + P_1^a x_{1j} - P_0^a y_{0j} - P_1^a y_{1j} - R_j^a] \qquad \text{A.1}$$

where x_{ij}, y_{ij} are respectively j's consumption and endowment of good i. P_i^V is the accounting price of good i in Country V and R_j^V is j's share of Country V's tariff revenue. Solving the first order conditions from (A.1) provides j's demand functions,

$$x_{ij} = x_{ij}(P_0^a, P_1^a, y_{0j}, y_{1j}, R_j^a) \qquad i=0,1 \tag{A.2}$$

which aggregate to Country A's market demand functions,

$$X_i^a = \sum_j x_{ij}(P_0^a, P_1^a, y_{0j}, y_{1j}, R_j^a) \qquad i=0,1.$$

In the aggregated demand functions, only the totals of the endowments, Y_i^a, and tariff proceeds, R^a, matter

$$\therefore \; X_i^a = \sum_j x_{ij} = \tilde{X}_i^a(P_0^a, P_1^a, Y_0^a, Y_1^a, R^a) \;\; i=0,1. \tag{A.3}$$

A dependence is present in the tariff proceeds in that

$$R^a = \sum_j R_j^a = t_{ab} P_0^b (X_0^a - Y_0^a) \tag{A.4}$$

where t_{ab} is A's ad valorem rate of tariff on imports from B and the bracketed term is A's excess demand for the imported good. The dependence is removed by using the relations between accounting prices in the three countries, the relations being

$$P_0^a = (1+t_{ab}) P_0^b \tag{A.5}$$

$$P_1^b = (1+t_{ba}) P_1^a = (1+t_{bc}) P_1^c \tag{A.6}$$

$$P_0^c = (1+t_{cb}) P_0^b \tag{A.7}$$

Substitute A.5 into A.4 to obtain

$$R^a = \frac{t_{ab} P_0^a}{1+t_{ab}} (X_0^a - Y_0^a). \tag{A.8}$$

Equation A.8 may now be substituted into A.3, then, supressing the constant endowments and solving provides the market demand functions

$$X_i^a = X_i^a(P_0^a, P_1^a, t_{ab}) \qquad i=0,1. \qquad \text{A.9}$$

Converting to relative prices in the usual way with good 0 the numeraire equations A.9 become

$$X_i^a = X_i^a(P^a, t_{ab}) \qquad i=0,1 \qquad \text{A.10}$$

from which we obtain A's excess demand functions, equations (1) in the text, as depending only on A's relative price and A's tariff on imports from B,

$$F_i^a = F_i^a(P^a, t_{ab}) \qquad i=0,1 \qquad \text{A.11}$$

Country C has an identical trading pattern to Country A and the same procedure provides C's demand functions

$$X_i^c = X_i^c(P_0^c, P_1^c, t_{cb}) \qquad \text{A.12}$$

and the excess demands

$$F_i^c = F_i^c(P^c, t_{cb}) \qquad i=0,1 \qquad \text{A.13}$$

Country B has a dis-similar trading pattern yielding excess demands which are complicated by the receipt of tariff revenue from two sources at two rates

$$\therefore R^b = \sum_j R_j^b = -t_{ba}P_1^a(X_1^a - Y_1^a) - t_{bc}P_1^c(X_1^c - Y_1^c) \qquad \text{A.14}$$

In A.14, substitute for X_1^a from A.9 and also for X_1^c from A.12 obtaining

$$R^b = -t_{ba}P_1^a\left[X_1^a(P_0^a, P_1^a, t_{ab}) - Y_1^a\right] - t_{bc}P_1^c\left[X_1^c(P_0^c, P_1^c, t_{cb}) - Y_1^c\right].$$

Using A.5, A.6, A.7 in the previous equation, R^b may be expressed as

$$R^b = R^b(P_0^b, P_1^b, t_{ab}, t_{ba}, t_{bc}, t_{cb}).$$

At the appropriate place in the aggregation procedure for Country B substitute the above expression for R^b and convert to relative prices finally to obtain

$$F_i^b = F_i^b(P^b, t_{ab}, t_{ba}, t_{bc}, t_{cb}) \qquad i=0,1$$

which are equations (2) in the text.

Relationships Between Prices

The relative price of good 1 in Country B is

$$P^b = \frac{P_1^b}{P_0^b} = (1+t_{ba})\frac{P_1^a}{P_0^b}$$

from equation A.6. Substituting for P_0^b from A.5,

$$P^b = (1+t_{ab})(1+t_{ba})\frac{P_1^a}{P_0^a}$$

$$= (1+t_{ab})(1+t_{ba})P^a. \qquad \text{A.15}$$

Similarly,

$$P^b = (1+t_{bc})(1+t_{cb})P^c. \qquad \text{A.16}$$

Signs of Partial Derivatives

These partial derivatives show the effects of tariff changes <u>when domestic price is fixed</u> so that the substitution effects are not operating. The partial derivatives are thus income effects, operating through changes in tariff revenue, and are shown to have the same sign as the income effect (positive in the normal case).

$$\text{(i)} \quad h_{iab}^b = \left.\frac{\partial F_i^b(P^b, t_{ab}, t_{ba}, t_{bc}, t_{cb})}{\partial t_{ab}}\right|_{\substack{P^b, t_{ba} \\ t_{bc}, t_{cb}}} \qquad i=0,1 \qquad \text{A.17}$$

The subscripts after this partial derivative emphasise that all variables in F_1^b, except t_{ab}, are fixed. Equations A.15, A.16 provide

$$P^b = (1+t_{bc})(1+t_{cb})P^c = (1+t_{ab})(1+t_{ba})P^a \quad \text{A.18}$$

from which, given the constants specified in partial derivative A.17, we see that a reduction in t_{ab} increases P^a and leaves P^c unchanged. Country B's imported good thus has an unchanged price in the supplying Country C and an increased price in the supplying Country A. Exporters in C have no incentive to expand their exports to B since no terms change in the first equality of A.18. But importers in B reduce their imports from Country A, the supplier whose price increases. B's total imports decline. B's tariff rates are constant in the partial derivative so B's tariff revenue declines. When distributed to consumers in Country B the smaller tariff revenue, at the required constant domestic price, sets up income effects which normally reduce excess demands. Hence a decline in t_{ab} causes a reduction in F_i^b. Thus $h_{iab}^b>0$

(ii) $$h_{iab}^a = \frac{\partial F_i^a\,(P^a, t_{ab})}{\partial t_{ab}}\Bigg|_{P^a} \qquad i=0,1 \qquad \text{A.19}$$

Relative price is constant in this partial derivative implying that there is no substitution in consumption or production and that A's accounting prices move in equal proportions. Equation A.5 was

$$P_0^a = (1+t_{ab})P_0^b > t_{ab}P_0^b = \frac{t_{ab}P_0^a}{1+t_{ab}} \ .$$

Total tariff revenue is returned to consumers and $t_{ab}P_0^b = \frac{t_{ab}P_0^a}{1+t_{ab}}$ is the tariff revenue from one unit of imports. The inequality indicates that imports can not be self financing because the tariff revenue they generate is always less than the domestic prices. Thus, with fixed relative prices, an increase in imports would put Country A beyond its budget constraint. Imports, therefore, do not increase though the tariff rate t_{ab} in the partial derivative decreases. Country A's tariff revenue therefore declines and the consequent income effects at the fixed relative prices attach the positive sign to A.19, $h_{iab}^a > 0$

$$\text{(iii)}\quad h_{iba}^b = \left.\frac{\partial F_i^b(P^b, t_{ab}, t_{ba}, t_{bc}, t_{cb})}{\partial t_{ba}}\right|_{\substack{P^b, t_{ab} \\ t_{bc}, t_{cb}}} \qquad i=0,1$$

Notice that tariff proceeds per unit, $t_{ba}P^a = \frac{t_{ba}P^b}{(1+t_{ab})(1+t_{ba})}$, declines and apply a similar argument to that used for A.17, $h_{iba}^b > 0$.

CHAPTER 2
THE ANALYTICS OF A CUSTOMS UNION

There are not many thorough-going algebriac treat-treatments of the characteristics of trading arrangements. Meade (15), as he has done in other parts of international trade theory, made basic contributions to the theory of customs unions, with a fully integrated mathematical approach, as long ago as 1955. While Lipsey (12) is possibly the exception, although the main methods of his work are graphical and verbal, the next mathematically inte-grated study of the topic came in 1972 with Takayama's book (20). Takayama lays down a twenty one equation community indifference curve model for the two member union, trading two goods with the rest of the world, and obtains few results for the effort. Negishi (16) manipulates the marg-inal conditions for an optimum in the social welfare sense. His model does not explicitly treat production and consumpt-ion so yields conclusions in the normative branch of econ-omics only, and not on the positive side.

Among the reasons for the neglect of customs unions by the more mathematical writers, it may be that there has been an unnecessary complexity in the structure of the problem - Takayama does require a lot of equations - or an incomplete or improper formulation of the relevant questions. However, this treatment will show that a proportion of the problems so far studied in customs union theory can be expressed in a simple analytic form and precise results can be obtained from a model of few equations. The approach used is slightly innovative and it is as well first to look briefly at the formal statement of the problem in the usual methodology.

The customs union problem is an exercise in the theory of second best. As such it involves maximising a welfare function subject to the budget constraint, the transformation function and the tariff distortions. That is a moderately complex system having solutions which will not be explicit functions and which will generally be non linear. One could try to find the effects of a customs union by differentiating the solution equations and solving again for the welfare changes. The changes are of uncertain sign.

That, a technocratic procedure, is the recognised form for economic maximising since Samuelson's Foundations; it does not break open the Customs Union issue. The approach itself is questionable since it is available only for small tariff changes while the nature of trading arrangements often involves substantial movements in tariff schedules. An alternative method to be developed here deals with some matters which are substantive and others which are merely clarificatory. Part II contains a formal analysis of the substantial issues - an extension of the number of member countries in the customs union and a dissection of the existence of equilibrium. Part I lays down two basic relations for a small customs union and in presenting a diagrammatic treatment refines several results.

PART I

Trade Engel Functions

For community indifference curves to exist in a market demand framework Gorman (6, p.28) has shown it to be necessary and sufficient that (a) at a given price ratio different consumers must have parallel income-consumption paths and (b) the income-consumption paths are linear functions through the origin of the consumption space. Each price ratio is associated with a specific linear Engel function, the same for every individual, j. Thus, where d_{ij} is the demand for good i by consumer j at the relative price of good 1, $P=P^*$, we have

$$d_{0j} = kd_{1j} \quad k>0 \tag{1}$$

$$\therefore \quad \sum_j d_{0j} = k\sum_j d_{1j}$$

$$\therefore \quad D_0 = kD_1 \tag{2}$$

where D_i, $i=0,1$ is the market demand for good i. As long as $P=P^*$ good 0 and good 1 are demanded in the proportion k. Excess demands are defined as

$$F_i = D_i - S_i \qquad i=0,1 \tag{3}$$

where S_i is the supply of good i. At $P=P^*$ the transformation function provides the supply point S_0^*, S_1^*. Select two of the demand points on the line given by equation (2) and let those points be (D_0, D_1), (D_0', D_1'), noticing that they hold for $P=P^*$ since equation (2) is defined for that price.

Forming a ratio from equations (3) at $P=P^*$, using the fixed supply point and the selected demand points:

$$\frac{F_0-F_0'}{F_1-F_1'} = \frac{(D_0-S_0^*)-(D_0'-S_0^*)}{(D_1-S_1^*)-(D_1'-S_1^*)}$$

and substituting for D_0, D_0' from (2)

$$\frac{F_0-F_0'}{F_1-F_1'} = \frac{k(D_1-D_1')}{(D_1-D_1')}$$

$$= k. \tag{4}$$

As the excess demands are the amounts traded, equation (4) shows that the quantities traded of two goods change in the proportion k for the domestic price $P=P^*$; i.e. there is a linear relation

$$F_0^V = k^V F_1{}^V + c^V \tag{5}$$

applying for country V under a specified price ratio. Equation (5) is called a Trade Engel function since it is derived from an Engel function.

Consumers necessarily comply with (1) in community indifference curve models and convex individual indifference contours will then ensure that the consumption ratio, k, of good 0 to good 1 increases as the relative price of good 1 increases. Consequently k, the gradient in equation (5), increases with the domestic relative price. Close readers of this literature may notice the whimsey in the aggregate consumption ratio k: Viner has claimed to have introduced community indifference curves into trade problems; years later he denied a fixed consumption ratio interpretation of his work on customs unions and other writers subsequently examined that situation, some using right angled community indifference curves. Aggregate indifference contours are smooth in this paper yet the consumption ratios are fixed for two countries.

Budget Constraints

Multiple tariff schedules at home or abroad add a degree of complexity to the budget constraints which is removed by the following skeleton derivation. In the usual model, countries A and B form a customs union against C, the rest of the world. Member B, in return for exporting good 0, imports good 1 from member A and also from the rest of the world - while countries A and C are isolated from each other. Partner B's budget constraint contains two terms reflecting the disbursement of the revenue from the two tariff schedules it operates. Since domestic suppliers and households in B respond to the local prices of the goods the primitive form of B's budget constraint is

$$P_0^bD_0^b + P_1^bD_1^b = P_0^bS_0^b + P_1^bS_1^b - t_{ba}P_1^aF_1^a - t_{bc}P_1^cF_1^c \qquad (6)$$

where P_i^V is the accounting price of good i in country V and t_{VS} is country V's tariff on imports from country S. Terms F_1^a, $F_1^c < 0$ are the excess demands for good 1 in the exporting countries, providing B with positive tariff revenue. Domestic prices are linked by countries' tariff schedules through international trade therefore

$$\begin{aligned} P_0^a &= (1+t_{ab})P_0^b \\ P_1^b &= (1+t_{ba})P_1^a = (1+t_{bc})P_1^c \\ P_0^c &= (1+t_{cb})P_0^b \end{aligned} \qquad (7)$$

Country B's budget constraint now reduces, by way of (3), (7) to

$$F_0^b + (1+t_{bc})(1+t_{cb})\,\frac{P_1^c}{P_0^c}\,F_1^b + \frac{t_{ba}(1+t_{bc})(1+t_{cb})P_1^c}{(1+t_{ba})P_0^c}\,F_1^a \tag{8}$$

$$+\ t_{bc}(1+t_{cb})\,\frac{P_1^c}{P_0^c}\,F_1^c = 0$$

while for countries A and C respectively it is similarly found that the budget constraints are (1)

$$F_0^a + \frac{(1+t_{bc})(1+t_{cb})P_1^c}{(1+t_{ba})P_0^c}\,F_1^a = 0 \tag{9}$$

$$F_0^c + (1+t_{cb})\,\frac{P_1^c}{P_0^c}\,F_1^c = 0 \tag{10}$$

In the next two sections it is shown that a country's budget constraint and its Trade Engel function contain the information necessary to provide its equilibrium position.

Diagrammatic Treatment

One of Meade's trade indifference curves, the domestic price ratio and the budget line are brought together in the customary way to provide country A's trading equilibrium in Fig. 1. Country A imports good 0 and exports good 1, therefore $F_0^a>0$, $F_1^a<0$ and the equilibrium point,

---

(1) The equality of expenditure with income, where income includes the tariff proceeds, provides

$$P_0^aD_0^a + P_1^aD_1^a = P_0^aS_0^a + P_1^aS_1^a + t_{ab}P_0^b(D_0^a - S_0^a)$$

$$\therefore \quad D_0^a(P_0^a - t_{ab}P_0^b) + P_1^aD_1^a = S_0^a(P_0^a - t_{ab}P_0^b) + P_1^aS_1^a$$

Notice from (7) that $P_0^b = P_0^a - t_{ab}P_0^b$ and substitute from (7) so that all prices are expressed in terms of P_0^c, P_1^c. Apply (3) to obtain (9). Equation (10) has the same derivation.

E, is in the second quadrant. Line OA is A's budget constraint from equation (9) and DE shows the domestic price

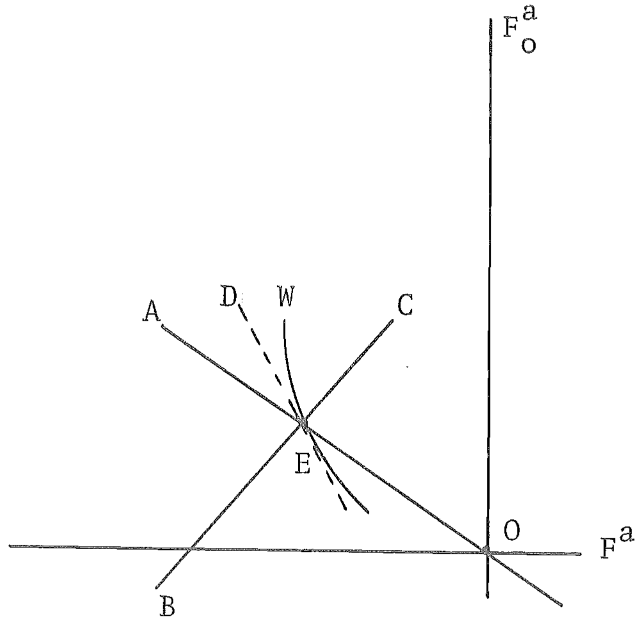

Fig. 1.

ratio reflecting the tariffs.(2) A trade indifference curve is tangent to our domestic price line at E. That domestic price ratio implies a particular Trade Engel Function, from equation (5), passing through E. One interpretation of point E, the equilibrium position is that it is generated by the intersection of the budget line and a domestic price line tangential to a trade indifference curve. Another useful interpretation of the equilibrium is

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(2) All the budget constraints in the paper are more general than the usual budget constraints used in international trade. Typically, the effect of other countries tariffs are not under consideration which is why other writers' budget constraints have a slope equal to the world price ratio. Even some other papers on customs unions implicitly assume that the rest of the world does not impose tariffs on union goods. The rest of the world is allowed to impose tariffs in this model so union member's budget constraints have slopes differing from the domestic price ratio in the outside world.

that it is the intersection of the budget line (equation 9) with BC, the Trade Engel line (equation 5) for the domestic price ratio. The second interpretation allows one to dispense with the trade indifference curve and the domestic price ratio.

Country C, representing the rest of the world, is like member A in that each imports good 0 from, and exports good 1 to, member B. The diagram for C will therefore show a second quadrant equilibrium similar to Fig. 1. Member B with a pattern of trade such that $F_0^b<0$ and $F_1^b>0$, has a solution in the fourth quadrant. The diagrams are now used to show the effects of a customs union.

Two proximate causes initiate the consequences of union. They are fixed prices, P_0^c, P_1^c in the rest of the world and reductions in t_{ab}, t_{ba} when the other tariffs in the system, t_{bc} and t_{cb}, are constant. Immutable prices P_0^c, P_1^c in country C keep that country on its initial Trade Engel line. C's budget line is unaffected by variations in t_{ab}, t_{ba} as a glance at equation (10) shows. With no changes registered in C's budget line or in its Trade Engel line it follows that equilibrium in the rest of the world is unaltered by the formation of a customs union between countries A and B. The quantities of goods 0 and 1 which C trades are unchanged and since C trades only with B there is no alteration in the amounts which C exports to and imports from member B. Welfare levels are thus constant in the rest of the world.

Injecting a world market clearing condition, $F_1^a = -F_1^b-F_1^c$, into member B's budget constraint - equation (8) - allows us to write it in a form more convenient for graphical analysis:-

$$F_0^b = \frac{-(1+t_{bc})(1+t_{cb})P_1^c}{(1+t_{ba})P_0^c} F_1^b + \frac{(1+t_{cb})P_1^c}{(1+t_{ba})P_0^c} (t_{ba}-t_{bc})F_1^c \qquad (11)$$

The final term in (11) is the vertical intercept of B's budget equation; F_1^c, country C's imports, are constant throughout as we have seen. The final term may take either sign, but when t_{ba} is reduced the vertical intercept shifts down. The slope of B's budget line is

$$\frac{dF_0^b}{dF_1^b} = \frac{-(1+t_{bc})(1+t_{cb})P_1^c}{(1+t_{ba})P_0^c} \qquad (12)$$

$$< 0$$

and a reduction in t_{ba} makes the slope steeper or more negative. B's pattern of trade implies a fourth quadrant solution in Fig. 2.

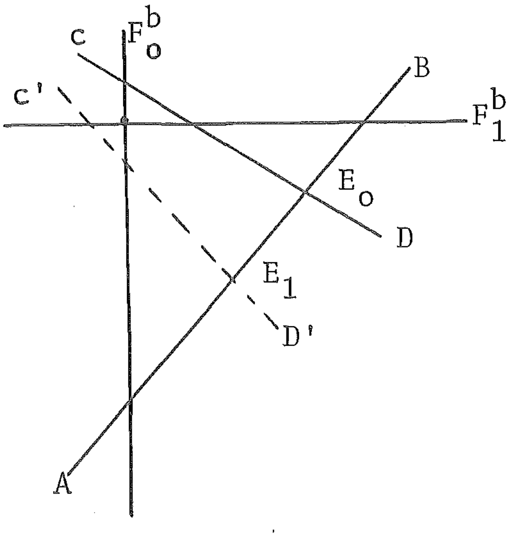

Fig. 2

Prices in the rest of the world are constant and, since there are no variations in the tariffs between member B and the rest of the world, domestic prices in B are constant too.(3) Member B is confined to its initial Trade Engel line AB in Fig. 2. Partner B's budget constraint, equation (11), is affected by the union and as t_{ba} is reduced the vertical intercept has been shown to shift down while the slope steepens. C'D' becomes B's budget line after union, the equilibrium point changes from E_0 to E_1. Member B's imports decline and exports expand after union and E_1 involves a lower level of welfare. The deterioration in welfare occurs because the fixed price ratio ensures constant domestic supplies of each good; since B's imports decline the consumption of the importable therefore declines too, and the increased exports occur at the expense of local consumption. Later, it will be useful to have recalled at this point that C's exports and imports are constant.

Tariffs between partners A and B do change with union and because A trades only with B there is variation in A's domestic prices. Tariff links between B and the rest of the world keep B's domestic prices P_0^b, P_1^b constant. We have, from system (7),

$$P_0^a = (1+t_{ab})P_0^b \tag{13}$$

$$P_1^b = (1+t_{ba})P_1^a \tag{14}$$

For a declining t_{ab} and fixed P_0^b we see that P_0^a declines; a reduced t_{ba} for fixed P_1^b increases P_1^a . Union membership for country A therefore raises A's domestic relative price,

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(3) Modified tariffs between the rest of the world and the union can easily be incorporated into equations (5), (11). It is not usual to do so.

P_1^a/P_0^a. Convexity of individuals indifference curves under equation (1) increases the gradient k in equations (2), (5) for country A as a consequence of the greater relative price of good 1. Fig. 3 shows how member A's steeper Trade Engel line takes position A'B'.

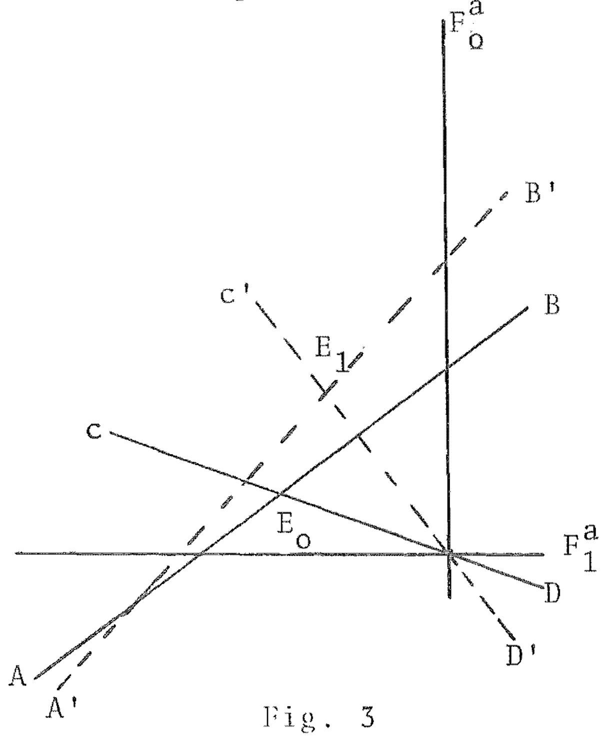

Fig. 3

New tariff schedules in the union affect member A's budget constraint as a review of equation (9) indicates. The slope there is

$$\frac{dF_0^a}{dF_1^a} = \frac{-(1+t_{bc})(1+t_{cb})P_1^c}{(1+t_{ba})P_0^c} < 0 \qquad (15)$$

and the slone becomes steeper (more negative) as t_{ba} is reduced. Line C'D' is member A's budget constraint after the union. Equilibrium changes from point E_0 to E_1 for country A after it unites with country B. Curves swinging the way they do necessarily increase the value of F_0^a, partner A's excess demand for imports. What is the movement in F_1^a, A's exports? Recall here that country C's exports of good 1 were constant. Since C trades only with B,B's imports of good 1 from C are therefore fixed. However, B's total imports of good 1 declined in Fig. 2 implying a fall in B's imports of good 1 from A, i.e. A's exports of good 1 declines; E_1 is A's new equilibrium. It is later shown that A's welfare increases.

Summarising to here, it has been shown that trade with the rest of the world is neither created nor is it diverted - there is an unchanged volume of trade between country C and the union. Within the union, trade in the export good of the member country isolated from the rest of the world shrinks while the quantity traded of that country's importable expands. Welfare in the rest of the world is unaffected by union, welfare in the isolated member improves while the welfare of the partner trading inside and outside the union deteriorates.

PART II

The Analytics of a Union

Solving equation (5) for each country with its budget constraint provides a country by country solution provided world equilibrium exists for an international economy containing a small customs union. For country A expressions (5), (9) have solution values,

$$F_0^a = \frac{c^a \alpha^a P^c}{k^a + \alpha^a P^c} > 0 \qquad (16)$$

$$F_1^a = \frac{-c^a}{k^a + \alpha^a P^c} < 0 \qquad (17)$$

where $\alpha^a = \dfrac{(1+t_{bc})(1+t_{cb})}{(1+t_{ba})}$ and $P^c = \dfrac{P_1^c}{P_0^c}$ is the real price of good 1 in country C. The signs are the consequence of the pattern of trade.

Equations (5), (9) carry a remarkable amount of information. The economy is non linear yet for a particular price ratio it is described by a linear system. The implicit forms of the underlying supply and demand functions have been cozened into providing explicit solutions for the given price in (16), (17) - something unusual in economics. The solutions are unique, since $k^a \neq -\alpha^a p^c$, a useful property when it comes to making welfare comparisons.

In matching fashion the solutions for the rest of the world, from (5), (10), are

$$F_0^c = \frac{c^c \alpha^c p^c}{k^c + \alpha^c p^c} > 0 \tag{18}$$

$$F_1^c = \frac{-c^c}{k^c + \alpha^c p^c} > 0 \tag{19}$$

where $\alpha^c = (1+t_{cb})$ and again the signs follow from the world trade pattern.

Solutions for member B are available although the simplicity of the four previous expressions make it more convenient to obtain B's results indirectly through the world market clearing conditions,

$$\sum_V F_i^V = 0 \qquad i = 0,1 \tag{20}$$

together with equations (16)-(19).

Expressions (16) - (19) allow one to find exactly the alterations, brought on by union, in the quantities of each good traded by the three countries. Letting primes indicate the value of a variable after union and by substituting for α^a, $\alpha^{a'}$, equation (16) provides the change in member A's imports

$$F_0^{a'} - F_0^a = \frac{c^{a'} \alpha^{a'} p^c}{k^{a'} + \alpha^{a'} p^c} - \frac{c^a \alpha^a p^c}{k^a + \alpha^a p^c}$$

$$= \frac{(1+t_{bc})(1+t_{cb})p^c}{(k^{a'}+\alpha^{a'}p^c)(k^a+\alpha^a p^c)} \left[\frac{(1+t_{bc})(1+t_{cb})}{(1+t_{ba})(1+t'_{ba})}(c^{a'}-c^a) + \frac{k^a c^{a'}(1+t_{ba}) - k^{a'} c^a (1+t'_{ba})}{(1+t_{ba})(1+t'_{ba})} \right] \quad (21)$$

$$> \quad 0$$

since; (i) all variables are positive in sign, (ii) $(1+t_{ba}) > (1+t'_{ba})$ by the union agreement and (iii) $c^{a'} - c^a > 0$, $k^a c^{a'} > k^{a'} c^a$ as shown in the appendix to this Chapter. The interpretation of (21) is that member A's imports expand after the union. That result, as do those which follow, holds for infinitesimal and for discrete changes in the union's tariff structure.

Inspection of equations (18) and (19), remembering that relative price is constant in the rest of the world, shows that quantities traded by country C are unaffected by the union agreement.

$$\therefore \; F_i^{c'} - F_i^c = 0 \qquad i = 0,1 \qquad (22)$$

Country B's results follow easily: world market clearing requires that the changes in countries excess demands sum to zero for each good

$$\therefore \; \sum_v (F_i^{v'} - F_i^v) = 0 \qquad i = 0,1 \qquad (23)$$

Using (21), (22), (23)

$$F_0^{a'} - F_0^a = -(F_0^{b'} - F_0^b)$$

$$> 0$$

$$\therefore \quad F_0^{b'} - F_0^b < 0 \tag{24}$$

or, member B's exports increase. Turning to B's imports, from equation (5) we see that

$$\begin{aligned} F_0^{b'} - F_0^b &= k^{b'}F_1^{b'} + c^{b'} - k^bF_1^b - c^b \\ &= k^b(F_1^{b'} - F_1^b) \end{aligned} \tag{25}$$

because fixed tariffs with the rest of the world and constant prices there ensure that B's domestic prices are fixed, implying that $k^{b'}=k^b$, $c^{b'}=c^b$ from (5). Relations (24) and (25) imply that

$$F_1^{b'} - F_1^b < 0 \tag{26}$$

i.e. member B's imports decrease. Finally expressions (22), (23), (26) show that the change in member A's excess demand for its exportable is

$$F_1^{a'} - F_1^a = -(F_1^{b'} - F_1^b) > 0 \tag{27}$$

i.e. country A's exports decrease.

Welfare Effects

Meade's trade indifference curves can be directly employed with the results obtained on changes in traded quantities to show how each country's welfare is affected by the union. His trade indifference contours are formed from the surface

$$W^v = W^v(F_0^v, F_1^v) \qquad v=a,b,c \tag{28}$$

which is an increasing function of each variable. Substituting from (22) into (28) provides the welfare effects the union has on country C:-

$$\begin{aligned} W^{c'} - W^c &= W^c(F_0^{c'}, F_1^{c'}) - W^c(F_0^c, F_1^c) \\ &= 0 \end{aligned} \tag{29}$$

i.e. the union has no impact on the welfare of the rest of the world. The outcome for partner B is

$$\begin{aligned} W^{b'} - W^b &= W^b(F_0^{b'}, F_1^{b'}) - W^b(F_0^b, F_1^b) \\ &< 0 \end{aligned} \tag{30}$$

since $F_0^{b'} < F_0^b < 0$, $0 < F_1^{b'} < F_1^b$ from equations (24), (26). Relation (30) shows that the partner trading inside and outside the union is worse off as a result of the agreement. Similarly for member A

$$\begin{aligned} W^{a'} - W^a &= W^a(F_0^{a'}, F_1^{a'}) - W^a(F_0^a, F_1^a) \\ &> 0 \end{aligned} \tag{31}$$

because $0 < F_0^a < F_0^{a'}$; $0 > F_1^{a'} > F_1^a$ from relations (21), (27). Thus union has the effect of increasing the welfare of the member trading only within the union.

Comparison of Some Results

Vanek (21) and Kemp (9) have studied the two country customs union in the community indifference curve class of models presented here. Before moving to the many country union it is worth noting the refinement that has occurred in the results so far obtained for the fixed union terms of trade model. A principal clarification is in the role of inferior goods. As equations (2) and (5) indicate they are not present in community indifference curve models and the results obtained here are free of the qualification made by other investigators. Another clarification is on the volume of the small union's trade with the rest of the world. Vanek (21, p.212) and also Kemp (9, p.31) were unable to isolate trade creation from trade diversion between the rest of the world and the small union. Equations (22) show that the quantities which the outside countries exchange with the union are invariant, trade is neither creater nor is it diverted. Vanek's conclusion that, "for the small union of disimilar economies, intra union trade must expand" (21,p.212), is contradicted by inequalities (21) and (27). Of some significance for the theory is the finding that the small union has no impact whatsoever on the rest of the world.

Increased Union Membership

Scant effort in the theoretical literature has been applied to the customs union of more than two members. Two member customs unions do exist in the real world though multiple membership is more common. The analysis can be extended to unions of three or more members in a direct manner if world equilibrium exists, a problem postponed until the next section. It is trivial to multiply the number unit cells consisting of countries like A and B above. There would be no trading relations between cells and such an arrangement could scarcely be called a customs union even though a common tariff schedule could apply to all cells. What does constitute a meaningful extension to the number of members of a trading arrangement is the introduction of a further member A_1, which, like member A draws good 0 from member B and not from the rest of the world. That is a three member customs union. Evidently a multi-country customs union consisting of countries A_1, A_2, ... A_n, B is possible, each country A_j trading only with B while B trades inside and outside the union.

Members A_j have the budget constraints given by equation (9) and equation (10) is the unchanged budget constraint for C, the rest of the world. The system for the world as a whole containing the world market clearing conditions, reflecting the inherent linear dependencies (further analysed below) is

$$F_0^1+\alpha_1\frac{P_1^c}{P_0^c}F_1^1 = 0$$

$$F_0^1-k^1F_1^1 = c^1$$

$$\vdots$$

$$F_0^n+\alpha_n\frac{P_1^c}{P_0^c}F_1^n = 0$$

$$
\begin{array}{lr}
F_0^n - k^n F_1^n & = c^n \\
F_0^c + \alpha_c \frac{P_1^c}{P_0^c} F_1^c & = 0 \\
F_0^c - k^c F_1^c & = c^c \\
F_0^1 + 0 + F_0^b \ldots + F_0^n + 0 + F_0^c \quad + 0 & = 0 \\
0 \quad F_1^1 + 0 + F_1^b + 0 \quad + F_1^n + 0 \quad + F_1^c & = 0
\end{array}
\tag{32}
$$

where the excess demands for members $A_1, A_2, \ldots A_n$ are respectively F_i^1, F_i^2, ..., F_i^n $i=0,1$; F_i^b, F_i^c, $i=0,1$ are the respective excess demands in member B and in the rest of the world; $\alpha_j = \frac{(1+t_{bc})(1+t_{cb})}{(1+t_{bj})}$ for countries $A_1, A_2, \ldots, A_n$; $\alpha_c = (1+t_{cb})$. Permuting columns provides the generalised solution to the world system (32) for the members A_j and for country C, i.e.

$$
F_0^j = \frac{c^j \alpha_j P^c}{k^j + \alpha_j P^c} \qquad j=1,2, \ldots, n,c \qquad (33)
$$

$$
F_1^j = \frac{-c^j}{k^j + \alpha_j P^c}
$$

Partner B's solution is available from (32) but it is more easily obtained through the world market clearing conditions and the equilibrium quantities for all other countries. Identical operations as were applied to equations (20) - (31) for the two member union yield the same the same conclusions. Hence the welfare and volume of trade results in the previous sections generalise to the union of artibrary size.

Existence of Equilibrium

An invalid assumption is contained in the literature on the small customs union. The presumption that an equilibrium solution generally exists for the community indifference curve model of the small union is not justified. Passing mention was made in the previous section of the inherent linear dependencies; these are now examined. The argument to be used applies to the many member union though to relieve the notational burden only the two country union will be treated. Walras' Law and market clearing requirements assure that there is a linear dependence between the budget constraints and the conditions for world equilibrium in each market. One of the countries' budget constraint is therefore eliminated from the system of equations which becomes, where $\tilde{\alpha}_j = \alpha_j \dfrac{P_1^c}{P_0^c}$:-

$$F_1^a + \tilde{\alpha}_a F_1^a = 0$$

$$F_0^a - k^a F_1^a = c^a$$

$$F_0^c + \tilde{\alpha}_c F_1^c = 0$$

$$F_0^c - k^c F_1^c = c^c$$

$$
\begin{array}{lllll}
 & & F_0^b - k^b F_1^b & = & c^b \\
F_0^a & + F_0^c & + F_0^b & = & 0 \\
F_1^a & + F_1^c & + F_1^b & = & 0
\end{array} \tag{34}
$$

after B's budget constraint has been eliminated and the world market clearing conditions included. Now the rank of the matrix formed from the coefficients on the left of system (34) is 6 because in general a non zero 6x6 determinant can be formed from that matrix. An augmented matrix formed by supplementing the left hand side coefficients with the vector of constants in (34) has a rank of 7, since the 7x7 determinant formed from the augmented matrix takes the value

$$(k^a+\tilde{\alpha}_a)\left[c^c(k^b+\tilde{\alpha}_c) + c^b(k^c+\tilde{\alpha}_c)\right] + (k^c+\tilde{\alpha}_c)(k^b+\tilde{\alpha}_a)c^a \neq 0 \tag{35}$$

in general. Thus, because the rank of the augmented matrix exceeds the rank of the matrix of coefficients in system (34) a solution, in general, does not exist (7,p.169). Further restrictions must be placed on the system to guarantee the existence of a solution to the small country customs union problem. One such restriction from (35) is $k^a=k^b=k^c$ <u>and</u> $\sum_v c^v=0$, a requirement that is <u>not</u> equivalent to identical income-consumption paths betweeen countries.

A resolution of the paradoxical conclusion of the non existence of equilibrium in the case of a small country union is required, the more so since Shoven (19) has proved the existence of equilibrium for the most general class of customs unions. What Shoven showed is that price vectors for each country exist such that the world system attains a full equilibrium and so does each country. A change in one or more of Shoven's parameters results in a new set of equilibrium price vectors which is different in general from the initial equilibrium price vectors. This is the feature that has been picked up in the above analysis. By altering their tariffs union members initiate parameter changes in the general equilibrium system and, as is well known, new price vectors in every country generally emerge. That is the sense in which the small customs union does not exist. However, such a non-existent small customs union is really a red herring because one may comfortably redefine the small customs union to be one causing <u>no</u> <u>appreciable</u> price variation in the rest of the world. The price changes in the rest of the world, stemming from the formation of a small customs union, are to be imperceptible.

APPENDIX TO CHAPTER 2

(i) $c^{a'} - c^{a} > 0$

Equation (5) gives member A's Trade Engel Function:

$$F_0^a = k^a F_1^a + c^a$$

Substituting from relation (3)

$$c^a = D_0^a - S_0^a - k^a(D_1^a - S_1^a) \tag{A1}$$

by using equation (2)

$$c^a = k^a S_1^a - S_0^a$$

$$= k^a S_1^a\left(\frac{P_1^a}{P_0^a}\right) - S_0^a\left(\frac{P_1^a}{P_0^a}\right)$$

$$\therefore\; c^{a'} - c^a = k^{a'} S_1^a\left(\frac{P_1^{a'}}{P_0^{a'}}\right) - k^a S_1^a\left(\frac{P_1^a}{P_0^a}\right) + S_0^a\left(\frac{P_1^a}{P_0^a}\right) - S_0^a\left(\frac{P_1^{a'}}{P_0^{a'}}\right)$$

$$> 0 \tag{A2}$$

since from the discussion around equations (13), (14) the relative price of good (1) increases so that (a) $k^{a'} > k^a$ from the convexity of individuals indifference curves under equation (1), (b) $S_1^a\left(\frac{P_1^{a'}}{P_0^{a'}}\right) > S_1^a\left(\frac{P_1^a}{P_0^a}\right)$ and $S_0^a\left(\frac{P_1^a}{P_0^a}\right) > S_0^a\left(\frac{P_1^{a'}}{P_0^{a'}}\right)$ from the concavity of the transformation function.

(ii) $k^V c^{V'} > k^{V'} c^V$

The linear Trade Engel Functions, (5), have different slopes for different domestic prices. Take the equations for two Trade Engel Functions and solve, $\tilde{F}_i^V$ being the solution values for country V

$$\tilde{F}_0^V - k^V \tilde{F}_1^V = c^V$$

$$\tilde{F}_0^V - k^{V'} \tilde{F}_1^V = c^{V'}$$

$$\therefore \quad \tilde{F}_1^V = -\left[\frac{c^{V'} - c^V}{k^{V'} - k^V}\right] \qquad \text{(A3)}$$

$$< 0 \quad \text{from (A2)}$$

$$\therefore \quad \tilde{F}_0^V = \frac{k^{V'} c^V - k^V c^{V'}}{k^{V'} - k^V} \qquad \text{(A4)}$$

substitute for c^V from (A1) into (A4)

$$\therefore \quad \tilde{F}_0^V = \frac{k^{V'} k^V \left[S_1^V \left(\frac{P_1^V}{P_0^V}\right) - S_1^V \left(\frac{P_1^{V'}}{P_0^{V'}}\right) \right] + k^V S_0^V \left(\frac{P_1^V}{P_0^V}\right) - k^{V'} S_0 \left(\frac{P_1^{V'}}{P_0^{V'}}\right)}{k^{V'} - k^V}$$

$$< 0 \qquad \text{(A5)}$$

from requirements (a), (b) in the discussion following (A2). (A5) and (A4) imply

$$k^{V'} c^V - k^V c^{V'} < 0 \qquad \text{(A6)}$$

CHAPTER III

THE MANY GOOD CUSTOMS UNION

Much of the formal work in customs union theory has been confined to the study of the two commodity world (Vanek (21), Kemp (9)) partly because complementarity between goods does not arise to provide difficulties and partly because there is a unique pattern of (free) trade in the three country - two good statement of the customs union problem. Difficulties associated with more complex schedules of tariffs are avoided in the two good case. Such problems indicate that the departure from the two good model to the three or more good model is a long step and it is one that has been taken by significant researches in the field, the work by Lipsey (12) and the study of Meade's (15), both undertaken in the 1950's and Corden's unpublished recent work. Unqualified results were not obtained by the work of those theorists and many of their conclusions had to be stated in the form that: a particular conclusion holds provided the volume of trade expands - however, if trade does not expand then another conclusion holds. The problem's intracability forced other statements of the form:

<u>it is more likely that</u> (.....). An approach which pins down the directional movement of the trade volume as an integral part of the three good customs union model seems essential to further progress in the area. Such an approach is developed here and, in fact, it will turn out that welfare effects can be fully determined by comparing equilibria, as can changes in trade volumes - references to which become superfluous in the statements on countries' welfare. A second line of development is to extend the number of goods, beyond the three examined by Lipsey, while preserving results.

<u>A Many Good Customs Union</u>

In Lipsey's problem (12 p.32) it was necessary to restrict both the pattern of production and the pattern of trade. The situation was that countries A and B, the union members, were specialized in production to the extent that each manufactured its export good, and only its export good, so that each could export just one commodity. We will relax those assumptions, allowing them as a special case, although the "small union" assumption of constant prices outside the union will be retained. The pattern of trade to be investigated is:

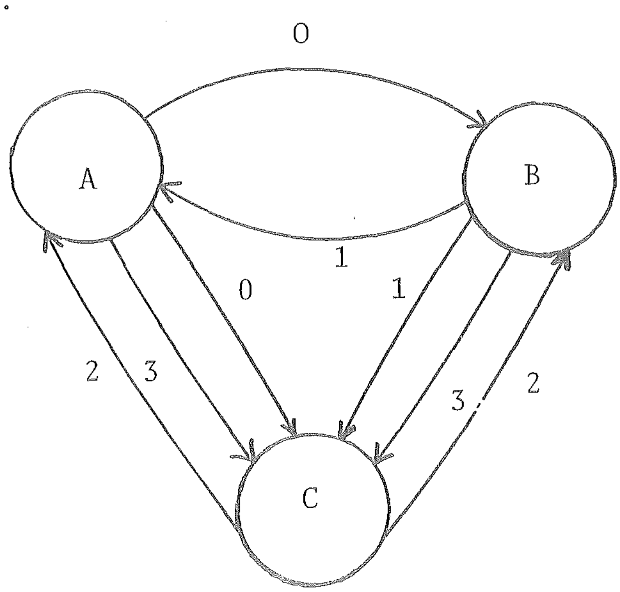

Fig. 1

where C indicates the rest of the world and the arrows indicate the directions in which goods 0,1,2,3 are flowing between countries. A four good world is represented which can be reduced to the dimensions of Lipsey's problem by restricting the supplies of and the demands for good 3 to be identically zero in every country. As the discussion will be in terms of the excess demands for the goods some supplies may be set at zero to obtain the production pattern for the Lipsey problem.

A Property of Trade Indifference Curves

It has been long known (Arrow & Hahn (2) pp 220,221) & Gorman (6)) that individuals must have identical Linear Engel lines at each price vector if community indifference curves are to exist and that the Engel lines must pass through the origin. That requirement imposes a condition on the Trade Indifference Curves, (1) overlooked in the

---

(1) In the two good case, where d_{ij} is individual j's consumption of good i at price ratio $P=P^*$; $d_{oj}=kd_{1j}$ is the required linear Engel line through the origin. Therefore, $\sum_j d_{oj} = k\sum_j d_{1j}$ or $D_o=kD_1$, is the relationship between market demands at $P=P^*$ since k has to be the same for all individuals. $P=P^*$ provides a unique point (S_o^*,S_1^*) on the transformation frontier. Let the excess demands be $F_i=D_i-S_i$ and select two points (D_o,D_1) and $D_o',D_1')$ on the aggregate Engel line, for $P=P^*$, having slope k. With price P^* the excess demands derived from the first point on the Engel line are $F_o=D_o-S_o^*$ and $F_1=D_1-S_1^*$. The excess demands corresponding to the second point on the Engel line are $F_o'=D_o'-S_o^*$ and $F_o'=D_o'-S^*$ thus

$$\frac{F_o-F_o'}{F_1-F_1'} = \frac{(D_o-S_o^*)-(D_o'-S_o^*)}{(D_1-S_1^*)-(D_1'-S_1^*)} = \frac{D_o-D_o'}{D_1-D_1'} = \frac{k(D_1-D_1')}{D_1-D_1'} = k$$

Or, for $P=P^*$ excess demands change in the constant ratio, k, along a linear function - the Trade Engel line.

international trade literature, and which is useful in the solution to Lipsey's problem. In the two good situation the linear Engel curve requirement carries through the individuals' and the community indifference curves over to the trade indifference curves; because, at given domestic prices the production point on the transformation function is fixed, so that the same ratio exists between excess demands as exists between the consumptions of the goods for the given domestic prices. For a given domestic price ratio, individual utility functions, all community indifference curves and all the trade indifference curves have the same slope and the points of common slope in each set of indifference functions are colinear, on lines all with the common slope k [(2)]

Hence $F_o = kF$ for $P = P^*$ so that points of equal slope for different trade indifference curves lie on a straight line with a positive gradient. And, from the convexity of the individuals' indifference curves a reduction in the relative domestic price of one good increases the consumption ratio of that good to the other; k then increases for the three types of indifference maps,[(3)] including the trade indifference curves. This effect of a domestic price change shows what happens to the ratio of the quantities of goods traded, the information being disclosed by the before and after points in the trade indifference map, and although it holds for the two good case alone, it will emerge to be half the answer to the Lipsey problem.

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(2) See note (1)

(3) Linear Engel curves preclude the inferiority case.

Budget Constraint

Expenditure on the four goods at domestic prices in country A is $P_{oa}D_{oa} + P_{1a}D_{1a} + P_{2a}D_{2a} + P_{3a}D_{3a}$, where D_{rs}, P_{rs} are respectively the demand for and the domestic accounting price of good r in country s, and this must equal income in the budget constraint. Income consists of the domestic value of output and the proceeds from the tariffs i.e.

$P_{oa}S_{oa}+P_{1a}S_{1a}+P_{2a}S_{2a}+P_{3a}S_{3a}+t_{1a}P_{1b}(D_{1a}-S_{1a})+t_{2a}P_{2c}(D_{2a}-S_{2a})$

where t_{ia} is country A's tariff on the imports of good i. Under the assumed pattern of trade country A's sources of imports are country B for good 1, and the rest of the world for good 2. Prices between countries are linked by the tariff schedules so that

$$P_{1a}=(1+t_{1a})\overline{P}_{1b} \text{ and } P_{2a}=(1+t_{2a})\overline{P}_{2c}$$

and we assume that good 3 is a free trade good though tariffs on good 3 in no way affect the conclusions. A referral to the pattern of trade shows that $\overline{P}_{oa}, \overline{P}_{1b}, \overline{P}_{2c}, \overline{P}_{3a}$, among others are constants from the small union assumption. Equating expenditure with income and substituting from the tariff links provides the budget constraint for country A in terms of domestic prices:

$$\overline{P}_{oa}F_{oa} + \left(\frac{P_{1a}}{1+t_{1a}}\right)F_{1a} + \left(\frac{\overline{P}_{2a}}{1+t_{2a}}\right)F_{2a} + \overline{P}_{3a}F_{2a}=0$$

where F_{ia} is the excess demand for good i in country A.

Implementing their customs union agreement, countries A, B reduce or eliminate their tariffs on each other's goods maintaining tariffs against the rest of the world which is therefore discriminated against. Reconsidering A's budget constraint, and also the pattern of trade, it is seen that

P_{oa}, P_{2a} and P_{3a} are unchanged since the rest of the world is the price setter, t_{2a} is constant under the union agreement while t_{1a} falls and so does P_{1a}, from the tariff links; ($\overline{P}_{1b}, \overline{P}_{2c}$ are fixed by country C). In all,one domestic price and one tariff rate change in partner A's budget constraint; the other domestic prices are constant. It is the constancy of those prices that contains the second half of the answer to Lipsey's problem.

The Composite Good and the Tariff Distortion

The great problem in the previous analyses of the three or more good union has been the rapidly increasing complexities introduced by pairwise complementarity and subsitutabily between goods. Without making arbitary assumptions on the complementary-substitution relation it has of course not been possible to impose a priori restrictions on the directions in which the demand curve for one good shifts when a tax or tariff is imposed on another good. Investigators have thus been forced into a taxonomy of cases if they wished to avoid arbitrary assumptions on the interrelated goods. General results have then not been obtained.

But it will be shown how the many-good-small-country union can be reduced to a two dimensional problem in the commodity space. The availability of this reduction has the valuable consequence of eliminating the need for the arbitrary assumptions on which pairs of goods are substitutes and which pairs are complements. The problem of assigning directions to the shifts in demand functions following the tax changes, it turns out, then disappears. The disappearance of this problem follows for the reasons that the many good problem can be collapsed to a two good problem and that the pure substitution effect is always negative in the two good case. Income effects do not upset that sign because all Engel curves are linear, ergo the need for assumptions on pairwise relations between goods is eliminated and more general results should be obtained.

When the prices of a group of goods are constant relative to each other those goods may be aggregated and treated as a single commodity, as Hicks (Value and Capital - Appendix) and later Samuelson (18, pp 141-143) have shown. Jones (8) and Berglas (3) have recently used the composite goods theorem in international trade problems, Jones on the supply side and Berglas on excess demands. The constant domestic price condition is met for goods 0,2,3 in country A and from that point of view they can be formed into a composite commodity. However, there are the distortion terms $\frac{1}{1+t_{1a}}$ and $\frac{1}{1+t_{2a}}$ present in the budget constraint and it must be proved that the composite goods theorem still holds when the tariff distortions exist. The proof under tariff distortions for the n good case appears in the appendix to this chapter. It is there that the transformation matrices operating on the price vector and on the excess demand vector to provide the composite good's excess demand under the tariff are given. By those transformations the excess demand for the composite good, defined over the goods 0,2,3, with the constant domestic prices, is

$$\overline{F}_{oa} = P_{oa}F_{oa} + \frac{\overline{P}_{2a}}{1+t_{2a}} F_{2a} + P_{oa}F_{3a}$$

so that the composite excess demand is three of the terms in the budget constraint and the budget constraint becomes

$$\bar{F}_{oa} + \frac{P_{1a}}{1+t_{1a}} F_{1a} = \bar{F}_{oa} + \bar{P}_{1b} F_{1a}$$
$$= 0$$

having substituted for $\frac{P_{1a}}{1+t_{1a}}$ from the tariff equations. The slope of the budget constraint is

$$\frac{dF_{1a}}{d\bar{F}_{oa}} = - \frac{1}{\bar{P}_{1b}} = - \frac{1}{P_{1a}/1+t_{1a}} < 0$$

which is a constant, because of the pattern of trade and the small union assumption, and is unaffected by the re-negotiated tariff schedules. Commodity 1 has a domestic price in country A of P_{1a} and

$$\frac{1}{P_{1a}} < \frac{1}{P_{1a}/1+t_{1a}} = \frac{1}{\bar{P}_{1b}} .$$

Also since, $\frac{1}{P_{1a}}$ is the relative domestic price of the composite good in terms of good 1 the domestic price line always has a lesser absolute slope than does the budget constraint. Individual's utility functions, community indifference curves and the trade and indifference curves have a common slope equal to the domestic price ratio, a slope less negative than the slope of the budget constraint so that equilibrium in the trade indifference curve diagram is given by point E, in fig. 2

The broken line through E is the domestic price ratio cutting a budget line (written as a function of the composite excess demand) and the domestic price line is tangent to U_o – a trade indifference curve also expressed in terms of the excess demand.[4]

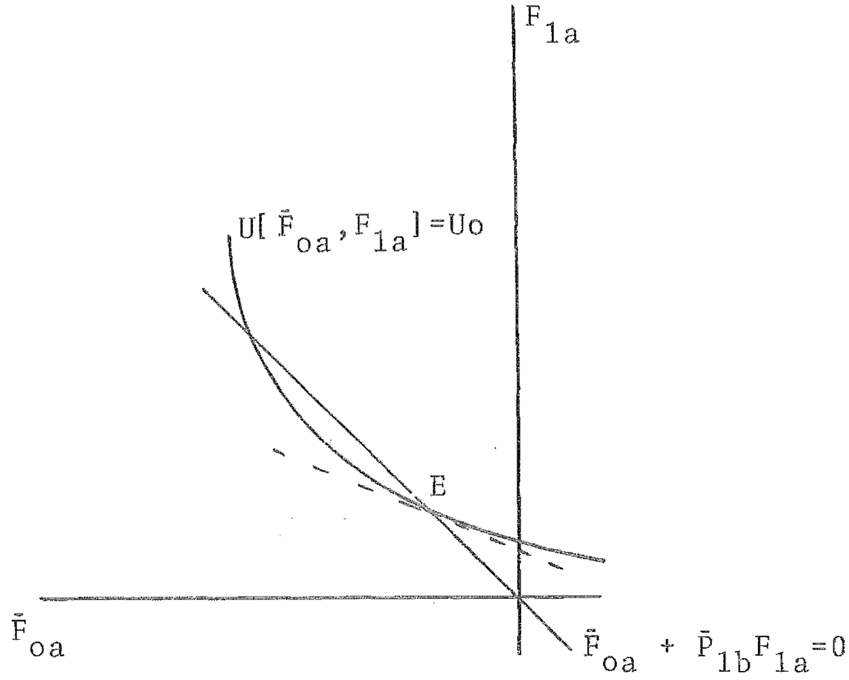

Fig. 2

The Solution to Lipsey's Problem

From the tariff equation

$$P_{1a} = (1+t_{1a})\,\bar{P}_{1b}$$

it is seen that the reduction in tariffs under the customs union agreement leaves $\bar{P}_{1b}$ unaltered while P_{1a} falls as t_{1a} is reduced. Thus the slope of the budget line in Fig. 2 stays constant, at $\frac{1}{\bar{P}_{1b}}$, while the slope of the domestic price line, $-\frac{1}{P_{1a}}$ becomes steeper but remains less steep than the budget line. Lastly, recall that

(4) It has been shown by Samuelson (18, pp 141-143) and it is shown in the appendix for the Lipsey case that the laws of demand continue to hold when the utility functions contain the composite good as a variable.

a reduction in the domestic price of good 1 necessarily increases the ratio of the quantity traded of good 1 to the quantity traded of the composite good(5) i.e. $k' > k$. The new equilibrium is given by E′ in Fig. 3

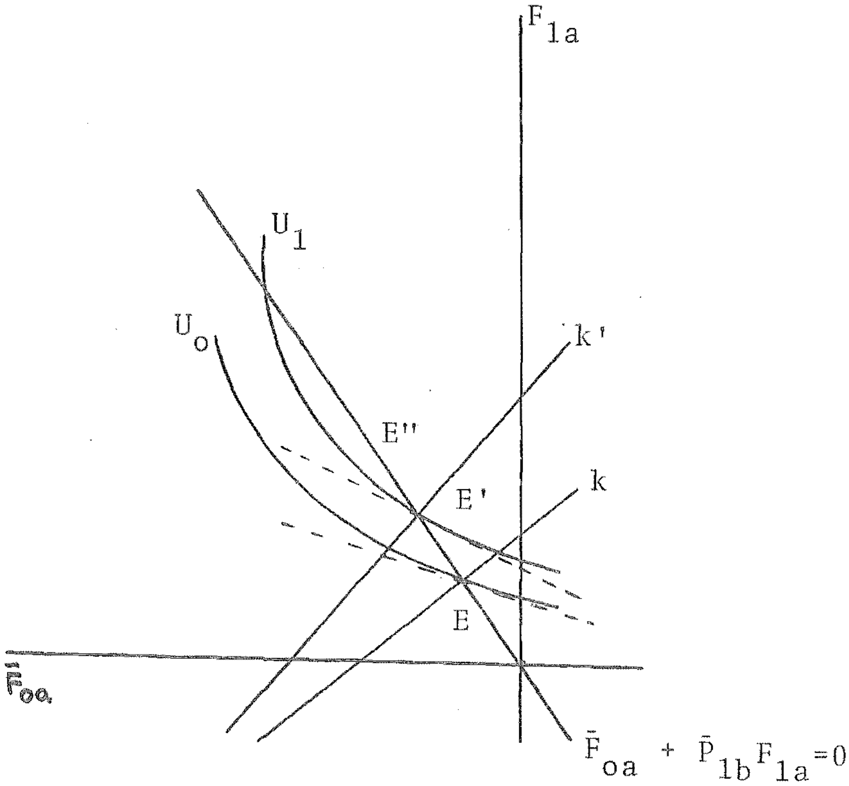

Fig. 3

At point E′, in comparison to point E, the domestic price line has become steeper and the relative quantity of good 1 traded has increased. The solution, then, to Lipsey's problem is that the customs union unambiguously raises the welfare of country A since E′ is on U_1, an indifference curve preferred to U_o. Furthermore, the quantity of good 1 imported and the amount of the composite good exported

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(5) By solving the equations for any pair of Trade Engel lines it can be shown that they necessarily intersect in the third quadrant, see the appendix to the previous chapter.

necessarily increase. Union partner B is symmetrical with country A, so B's welfare also increases[6] etc. There is a definite creation of trade within the union because member A imports good 1 only from member B and A's imports of that good increase; similarly B's imports of good o from A expand.

Lipsey (12) generalised his problem to its broadest conception in his appendices to Chapters Five and Six; he was there concerned with the second best problem of finding the optimum distortion to be placed on imports from the partner given that the other tariff distortions are to remain. As an exercise in the theory of second best this task has a ready resolution in Fig. 3. Given the budget constraint, the highest trade indifferences curve attainable is the one, not drawn, which is tangent to the budget line at say, point E". Tangency at that second best optimum requires the domestic price line and the budget line have the same slope; only when $t_{1a}=0$ does $-\frac{1}{P_{1a}} = \frac{1}{P_{1a}/1+t_{1a}}$ so that the second best optimum level of tariffs requires that country A eliminates the tariff on its partner's goods.

Comparison with Previous Results

Meade is acknowledged by Lipsey (11 p.39) to have obtained results similar to those which Lipsey derived. A revision of Meade's results, results which are at the core of the theor of the many good customs union, is now necessary. Earlier work suggested that;

"1. A partial customs union which only reduces tariffs on some imports is more likely to raise welfare than is a

(6) See Lipsey (11 pp. 32-33)

complete union which removes tariffs from some imports.

2. A customs union is more likely to raise welfare the higher is the level of tariffs which are reduced or removed in relation to the tariffs which are unchanged". (Lipsey (11) p. 38)

From the argument buttressing Fig. 3 on the second best optimum level of tariffs results 1,2 are seen not to be the case. A union which eliminates internal tariffs achieves the second best optimum, contrary to 1 above. Then, too, a tariff reduction within the union raises a member's welfare regardless of the initial (positive) level of tariffs in distinction from 2 above. Given a uniform tariff schedule prior to union there are two other results in the core of theory and in need of re-examination, as they are stronger than Lipsey claimed;

"3. A necessary condition for a customs union to increase welfare is that it results in a decrease in the purchases of domestic goods so that the volume of imports (measured in the constant international prices) increases". (Lipsey (11) p.38)

For the case Lipsey studied, (complete specialisation in the production of the export good), 3 is both necessary and sufficient - not merely a necessary condition - as will be seen by the construction of a diagram with community indifference curves and a transformation curve consisting of a point on the axis for the export good. It is stronger than claimed in the further sense that it does not require an initially uniform tariff. But the result does not apply when one departs from the assumption of specialised production.

One of Lipsey's results requires review,

"4. A sufficient (but not necessary) condition for a customs union to raise welfare is that it should result in an increase in the quantity purchased of all imports." (Lipsey (11) p.38)

From Fig. 3 one sees that result 4 has been modified and substantially strengthened. The condition on all imports is unduly restrictive since no more is required than an increase in imports from the partner country; imports from the rest of the world, contained within the excess demand for the composite good, may move in either direction while welfare still increases. Movement outwards along the budget line from point E is sufficient to increase welfare, and necessarily occurs, bringing with it an expansion of the imports of good 1 from the partner. Thus the expansion of imports from the partner between the equilibrium points is a necessary and sufficient condition for a welfare improvement in the customs union. The restated condition does not require the initial uniformity of tariffs nor does it need specialised production and it becomes a stronger conclusion than Lipsey claimed.

The overview of the Lipsey-Meade results is that, they did not make a prediction on welfare since the work from which they drew their conclusions did not determine whether the various conditions would hold or would not hold e.g.

"If a customs union is found in which the volume of international trade does not increase (assuming that international prices remain unchanged) it can be asserted that welfare cannot have increased.

"If, on the other hand, a customs union is found which causes an increase in the volume of trade in all commodities, it can be asserted that the union has caused an increase in welfare (again assuming that international prices do not change)." (Lipsey (11)p.40).

An application of the composite good theorem has now eliminated the "either better or worse off" nature of the welfare conclusion and extended it beyond the three-good-specialised-production-union-member situation. The result is now that in the generalized model of the Lipsey problem both partners gain as a result of the mutual tariff reduction arising from the union agreement and that trade expands between them.

Corden(7) working with a different trade flow than Lipsey, allows for changes in the pattern of imports as a result of union and he calls this variation in goods flow the <u>import pattern effect</u>. Corden finds that there are cases where the import pattern effect raises welfare. A type of import pattern effect which increases welfare can also occur in the present model in that a union member's imports of good 2 may fall to zero.

Finally, within the model, there is the kernel of a suggestion that the small customs unions of Africa, Australasia, the Carribean and Latin America should consider eliminating tariff between member states.

Appendix - over

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(7) Corden, W.M. The Effects of Customs Unions in a Multi-Commodity Model, unpublished mimeo.

The Composite Good Under Distortions

In deriving the transformations defining the composite good Samuelson shows first that the pure substitution effect is negative in the absence of the composite good, (18 pp. 107-108) and second that after applying two transformations defining the composite good the pure substitution effect remains negative, (18 pp. 141-143). Thus, given the conditions necessary for the transformations to hold, a sub group of commodities can be amalgamated in a special manner and treated as a single commodity for which the pure substitution effect is negative. A parallel procedure is set out here to show first that in the presence of price distortions the pure substitution effect is negative, and second that after applying two transformations under the distortions defining the composite good, the pure substitution effect remains negative. The heurstic treatment preceeds the formal proof:

In the heuristic treatment two considerations are presented by the existence of community indifference curves in the model and by the tariff distorted budget constraint, $P_oF_o + (P_1 /1+t_1)F_1 + (P_2 /1+t_2) F_2 + P_3F_3 = 0$. The first consideration is that at a given domestic price ratio the community indifference curve has the same slope as has each individual's indifference curve at that price ratio i.e. the community indifference curve has a slope equal to that domestic price ratio. The second consideration is that at the same time as the community indifference curve takes that price slope it also meets the distorted budget constraint. In two of the dimensions the equilibrium is shown, in Fig. A1, at point A.

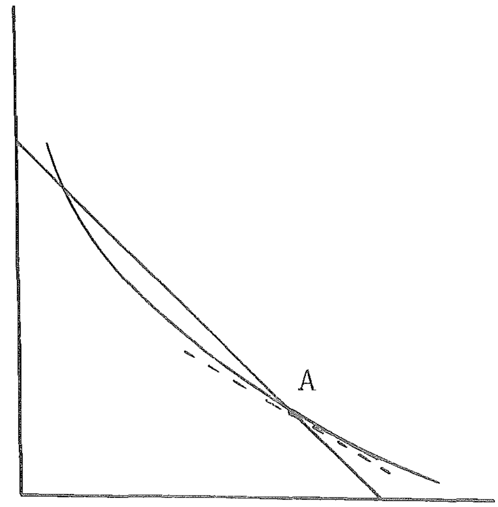

Fig. A1

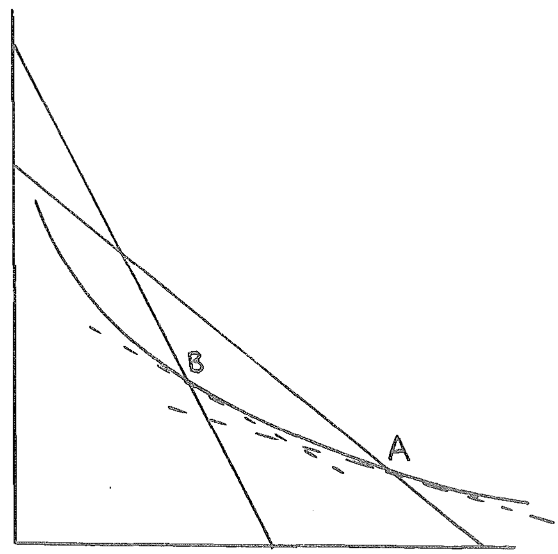

Fig. A2

The broken line through A is the domestic price line, the solid line through A is the tariff distorted budget constraint. Constraining the economy to U_o, by varying the budget line, when the domestic price ratio increases, results in point B and so the negative pure substitution effect under the tariff distortion.

At the beginning of the formal proof it is remembered that given the existence of community indifference curves income redistributions, at constant domestic prices, between individuals do not alter aggregate behaviour; thus as is usual, we proceed to use the community indifference curves in exactly the same way as Samuelson (Foundations Harvard University Press, 1965, p.108) used the individual's indifference curves to obtain the pure substitution effect for the individual. Introducing the distortion provides the pure substitution effect with the tariff. Let the budget constraint under distortions be

$$p\alpha x = \bar{Y}$$

where p is the row vector of domestic prices, α is the positive diagonal matrix $(\alpha_i) = (\frac{1}{1+t_i})$ of tariff distortions and x is the column vector of consumptions. The community minimises the expenditure to achieve a welfare level $U(x) = U_o$ to which it will be constrained. Consider two domestic price vectors p^o, p' and their associated cost minimising consumption vectors, respectively x^o, x'. Then since $U(x^o) = U(x') = U_o$ and cost is minimised

$$P'\alpha x' \leq P'\alpha x^o$$

$$\therefore \quad P'\alpha(x^o - x') \geq 0$$

&

$$P^o\alpha x^o \leq P^o\alpha x'$$

$$\therefore \quad P^o\alpha(x^o - x') \leq 0$$

$$\therefore \quad (P^o - P')\alpha(x^o - x') \leq 0 \tag{1}$$

yielding the generalised pure substitution theorem when there is a tariff distortion. When there are no tariff distortions $\alpha_i = 1 \ \forall \ i$ and the usual result is obtained from (1). Allowing the price of just one good, n, to change provides

$$\alpha_n \Delta p_n \Delta x_n \leq 0 \qquad \alpha_n > 0 \qquad (2)$$

and so the result that the own price pure substitution effect is negative for the whole economy in the presence of tariffs. The next problem is to show that inequalities (1), (2) hold after a transformation has been applied to the goods vector. This transformation will define the composite good. The transformation under the tariff distortions is one of an infinity of suitable transformations, as Samuelson (18, p.124n) has observed. Defining, for $\alpha_i > 0$ the tariff distortion associated with P_i, the transformed vector

$$\bar{P} \equiv \begin{bmatrix} \frac{1}{\alpha_o P_o} & 0 & 0 & 0 & \cdots & & 0 \\ \frac{-\alpha_1 P_1}{\alpha_o P_o} & 1 & & & & & \\ & & 1 & & & 0 & \\ \vdots & & & \ddots & & & \\ & & & & 1 & & \\ \frac{-\alpha_r P_r}{\alpha_o P_o} & & & & & \ddots & \\ 0 & & 0 & & & & \\ \vdots & & & & & & \ddots \\ & & & & & & 1 \end{bmatrix} \begin{bmatrix} \alpha_o P_o \\ \alpha_2 P_2 \\ \vdots \\ \alpha_r P_r \\ \vdots \\ \alpha_n P_n \end{bmatrix}$$

$$= \begin{bmatrix} 1 \\ 0 \\ \vdots \\ 0 \\ \alpha_n P_n \end{bmatrix}$$

and introducing the transformed goods vector,

$$\bar{X} = \begin{bmatrix} \alpha_o P_o & \alpha_2 P_2 & ---- & \alpha_r' P_r & --- & 0 \\ 0 & 1 & & & & \\ 0 & & 1 & & & \\ \vdots & & & \ddots & & \\ \vdots & & & & 1 & \\ \vdots & & & & & \ddots \\ 0 & & & & & 1 \end{bmatrix} \begin{bmatrix} x_o \\ x_1 \\ \vdots \\ \vdots \\ x_n \end{bmatrix}$$

$$= \begin{bmatrix} \sum_i^r \alpha_i P_i x_i \\ x_2 \\ x_3 \\ \vdots \\ x_n \end{bmatrix}$$

it is seen that $\bar{P}\ \bar{X} = \alpha PX = \bar{Y}$ or, the economy remains on its budget constraint after the transformations. Let $U(\bar{X}) = U_o$ and let $\bar{X}',\ \bar{X}^o$ be the expenditure minimising consumption quantities associated respectively with $\bar{P}',\ \bar{P}^o$. Then as before.

$$\bar{P}'\bar{X}' \leq \bar{P}'\bar{X}^o$$

$$\therefore \quad \bar{P}'(\bar{X}^o - \bar{X}') \geq 0$$

$$\& \qquad \bar{P}^o\bar{X}^o \leq \bar{P}^o X'$$

$$\therefore \quad \bar{P}^o(X^o - \bar{X}') \leq 0$$

$$\therefore \quad (\bar{P}^o - \bar{P}')(\bar{X}^o - \bar{X}') \leq 0 \qquad (1')$$

which is the result obtained in inequality (1). Allowing just the price of good n to vary, as before, relation (1′) yields

$$(\bar{P}^{o}-\bar{P}')(\bar{X}'-X^{o}) = \begin{bmatrix} 1 - 1 \\ 0 \\ \vdots \\ 0 \\ \alpha_n P_n^{o} - \alpha_n P_n' \end{bmatrix} \begin{bmatrix} \sum_i^{n-1} \alpha_i P_i' X_i - \sum_i^{n-1} \alpha_i P^{o} - X_i' \\ X_2 - X_2^{o} \\ \vdots \\ X_{n-1}' - x_n^{o} \\ X_n' - X_n^{o} \end{bmatrix}$$

$$= \alpha_n \begin{bmatrix} P_n^{o} - P_n' \end{bmatrix} \begin{bmatrix} X_n^{o'} - X_n' \end{bmatrix}$$

$$= \alpha_n \Delta P_n \Delta X_n \qquad \alpha_n > 0$$

$$\leq 0 \tag{2'}$$

The term in (2′) is exactly the term obtained in (2) so that the pure own price substitution effect with a tariff distortion may be obtained from the transformations defining $\bar{P}$, $\bar{X}$.

CHAPTER IV

A GENERAL EQUILIBRIUM MODEL OF THE GAINS FROM TRADING ARRANGEMENTS

National Income Analysis and Walrasian Economics

The entire body of macroeconomics focuses on the determination of, and changes in, the national income; the implicit rationale for the focus is that it is an economic variable of particular interest.[1] Growth theory, much of it directed to growth rates in income per head, is similarly oriented.

Macro magnitudes such as total expenditures on the demand side and output on the supply side, as well homogenous financial assets, are used to determine national income in the family of models stemming from Hicks' LM-IS analysis. The definitional equivalence of the final goods conception of national product and the factor income approach to national income is commonplace.

[1] The problems of national income as a measure of welfare are treated in Samuelson, P.A., "Evaluation of Real National Income", published in "Readings in Welfare Economics", Arrow, K.J., & Scitovsky, T., eds, Irwin, Homewood 1969, p.402-433.

An idea, central to this chapter, involves the exploitation of this commonplace concept. The equality of the finished goods and factor payment definitions of national income will be used to develop a model of the income changes from trade. Later, the model will be applied in measuring the changes in income from different trade situations; in particular, in measuring the income gains from the many forms of trading arrangements into which a country may enter.

Simple excess demand type macro models of National Income are scarcely cast in forms useful for estimation and the estimation of simultaneously determined macro variables involves, in practice, considerable departures from the concepts of, say, the LM-IS model. On some views the departures are seen as steps towards realism. The present construct also departs from the aggregative models in that it accumulates the national income variable from the microeconomic markets. It uses the factor income definition of national income. From the many markets for labour, entrepreneurs' activities and other factors' services, it arrives at national factor income. Thus, national income is a macro magnitude which in this chapter, is determined from its general equilibrium, micro-economic, factor market components.

<u>Quantifiable Gains From Trade</u>

Domestic National Income is defined as

$$Y = \sum_i w_i V_i \qquad (1)$$

where w_i is the price of one year's service of factor i and

V_i is the quantity of that domestic input supplied in the same year. Equilibrium in national income is established when each market in the economy is in equilibrium. Let w be the vector of relative domestic factor prices, P be the domestic relative price vector for other goods and V^d, V^s be the vectors of domestic factor demands and supplies. The general equilibrium vector factor demand and supply functions in the absence of distortions are then

$$\begin{aligned} V^d &= V^d(w,P) \\ V^s &= V^s(w,P) \end{aligned} \qquad (2)$$

and the equilibrium conditions in the economy require

$$V^d = V^s = V \qquad (3)$$

The equilibrium values of P, and of w, are determined in the Walrasian system for the economy as a whole, not from (2) alone. Confining the definition of P and of w to the equilibrium goods price and factor price vectors respectively, substitution of P, w into an equation in (2) provides V. Thus, the equilibrium value of real domestic national factor income, Y, is available;

$$Y = w\ V \qquad (4)$$

Prior to trade, the equilibrium goods price vector in a country differs from the world price vector, otherwise trade would not subsequently occur. World prices of traded goods (except for transport costs and the effects of protection) rule in the country after trade is established. Equilibrium national income therefore takes a pre-trade value which is in general different from its post trade value. Where the superscript "o" indicates the pre-trade equilibrium value of a variable and the absence of a superscript indicates its post-trade value, a general equilibrium measure of the INCOME GAINS FROM TRADE is

$$Y - Y^o = wV - w^oV^o \tag{5}$$

which may take either sign. This measure of the gains or losses in income from trade is robust in the sense that it holds whether markets are perfect or imperfect, whether there is free trade or when there is protection; it applies to countries which are large in relation to the rest of the world or insignificant in the world economy, and the definition remains valid in disequilibrium.

A country is small in international trade when the quantities of its exported and imported goods are so small as to have no effect on the world prices of these goods. That is to say it is a perfect international competitor. As such, it is faced with an invariant $P = \bar{P}$ which is determined on world markets, if it is the free trade economy we are momentarily assuming it to be and if all goods are traded. The small country assumption is useful in the present problem because equations (2) become

$$\begin{aligned} V^d &= V^d(w,\bar{P}) \\ V^s &= V^s(w,\bar{P}) \end{aligned} \tag{6}$$

National income itself can then be evaluated from the w and V contained in the solution values to the variables in (6). System (6) contains parameters, $\bar{P}$, and all the solution values for the variables in (6) will be functions of $\bar{P}$ i.e.

$$w = w(\bar{P})$$

and $\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ (7)

$$V = V(\bar{P})$$

Equilibrium national income is therefore

$$Y = w(\bar{P})V(\bar{P}) \tag{8}$$

An alternative interpretation may be placed on the equilibrium outcome of (6), an interpretation which relaxes the assumption of no non-traded goods. The vector, w, contains prices which are not determined on world markets and until now w, V have been defined as the factor price and domestic factors quantity vectors. Extending the definition of w to include all the prices of goods which are determined in the country's own markets, and not on world markets, allows one to introduce the general category of non-traded goods to the model. With such redefinitions of w and an appropriate definition of V one does not use the inner product, wV, as the national income; a summation restricted to factors is used instead. Some factor prices may be internationally determined, such as capital's rental, and will enter $\bar{P}$ in which case two summations are required.

Trading Arrangements and a Micro Analysis of National Income

Equations (6) are capable of econometric estimation for a given country, provided they can be identified. Once such estimates are completed the equilibrium values of w, V may be predicted from the reduced form of the estimated model - for a particular set of the pre-determined variables, $\bar{P}$. Forecasts of national factor income, again for certain $\bar{P}$, should then be available using the definition (8).

These forecasting techniques can be applied to the evaluation of a trading arrangement by using the relation between world and local prices after tariffs. When any country, large or small in relation to the rest of the world, imposes tariffs the domestic price vector, P, becomes

$$P = (I + t)P^{*} \tag{9}$$

where $(I + t)$ is the diagonal matrix of tariff rates, each tariff being positive, negative or zero and P^{*} is now the world C.I.F. price vector. Substituting (9) into a set of equations describing the entire economy will yield w, V and eventually the tariff ridden level national income. Tariffs levied by a small country do not affect world prices which remain at $P^{*} = \bar{P}$. Using (9), w and V, the domestic national income may be determined for a small country from

$$\begin{aligned} V^{d} &= V^{d}(w,\ (I + t)\ \bar{P}) \\ V^{s} &= V^{s}(w,\ (I + t)\ \bar{P}) \qquad (10) \\ \text{and} \qquad Y &= w\ V \end{aligned}$$

Equations (10); or more properly, forecasts from (10), permit a quantifiable income comparison of two tariff vectors, t and t' at a particular point in time, for a given $\bar{P}$. Letting primes indicate the equilibrium values of variables under the new tariff regimen and when the initial equilibrium values of variables are without primes, the change in national income attributable to a new level of tariffs in a small country is, using (8), (9),

$$Y' - Y = w[(I+t')\bar{P}]V[(I+t')\bar{P}] - w[(I+t)\bar{P}]V[(I+t)\bar{P}] \tag{11}$$

and equation (11) provides a quantifiable answer to the higher or lower tariffs issue in particular cases.

Elements $(1 + t_{i})$ of the tariff matrix may be treated as exogenous variables, if government imposes tariffs for reasons outside the system, or as endogenous variables;

$(1 + t_i)$ will be an endogenous variable if that tariff is levied in order, say, to protect wages. Equations for tariff formation become necessary supplements to system (10), in the dependence case, and the tariffs themselves are then endogenous variables in the estimating problem.

Many kinds of trading arrangements between small countries involve gains or losses that can be measured and evaluated as special cases of (11). For example, a unilateral movement to free trade would imply $t' = 0$; or, a tariff preference to a particular country modifies the tariff matrix in a way specified by an inter-country agreement. A FREE TRADE AREA involves exactly such an agreement. Equations (9) and (11) can thus form the basis for a procedure to estimate the change in New Zealand's national income consequent upon the Free Trade Agreement between Australia and New Zealand.

Equation (11) is the difference between two inner products or two summations. Each term in one of the sums is the income of a factor, so by disaggregating (11) the income change may be obtained factor by factor. Variations in the distribution of income, a consequence of a new trading arrangement, thereby became available and the interest different factors have in some tariff matrices over other tariffs matrices is revealed. The estimation method, used below, will go still deeper to reveal factor income by industry. One factor in an industry, in principle, may prefer a different tariff matrix to another factor in the same industry.

The Pseudo-Optimum Tariff

Since tariff changes alter national income in the manner shown it is a natural extension of the method to enquire which set of tariffs maximise national income. That set of tariffs is called the pseudo-optimum tariff to distinguish it from the Paretian concept of the optimum tariff. The literature on the optimum tariff shows how the government of a country with monopoly power on world markets may manipulate world prices to the country's advantage, in a Paretian sense, through its tariff policy. A small country, not having monopoly power, has a Paretian optimum tariff vector of zero i.e. on Paretian grounds it choses free trade.

National income maximisation and Paretian optima are different criteria and the Paretian optimum tariff vector of zero for the small country does not necessarily maximise national income. For example in the Heckscher-Ohlin model a small country may succeed in increasing national income at factor cost (through the Stolper-Samuelson theorem) by imposing a tariff. The removal of the tariff in that situation, though providing a Paretian improvement, reduces national factor income - a simple example of the divergent results from the different criteria.

The set of national income maximising tariffs may be found by maximising real national income with respect to the tariff vector subject to the budget constraint and solving for the tariff vector, i.e.

$$\text{Max } L = w[(I+t)\bar{P}]V[(I+t)\bar{P}] + \lambda[\bar{P}X - wV]$$

where λ is the Lagrangrian and X the consumption vector. The expression for the income maximising tariff vector, even in the two factor-two good case, is cumbersome and without simple interpretation.

Estimation Problems

The model is a general equilibrium construct where, from general equilibrium theory, all relative prices enter every supply and demand function. Economic theory provides no a priori information on the values of the coefficients of prices and in particular where they are zero (or on the mathematical form of the structural equations) and therefore this investigator has no basis for identifying the structural equations. As Liu (14, p.456) has pointed out ordinary least squares regressions on the predetermined variables in the reduced form is an acceptable estimation technique in this situation and allows consistent prediction of the values of the endogenous variables.

It is by no means clear that this lack of identification and the consequent use of O.L.S. on the reduced form is any loss from the point of view of prediction. FIML would in any case be ruled out as an estimating technique because of a lack of observations. However, were the structural form to be identified the technique used to estimate it would have been 2 SLS. Now Dhrymes (5) shows that, in general, one has no grounds based on asymptotic efficiency for prefering 2 SLS derived estimates of the restricted reduced form to OLS on an unrestricted reduced form viz.

Lemma 5: Unless (a) the covariance matrix of the structural errors is diagonal, or (b) all equations of the system are just identified, 2 SLS induced re-

> stricted reduced form are, asymptotically, neither efficient nor inefficient relative to unrestricted (OLS) reduced form estimators.
>
> Dhrymes (2 p.128)

Therefore even if the structural form were identified it is not clear that there would be any loss incurred by the use of OLS estimates of the reduced form rather than predictions based on 2 SLS estimates of the structural form.

The relatively small number of observations remains a problem in the selected estimation technique which may be overcome by either a two stage principal components approach or by using O.L.S. on the principal components of the predetermined variables. Some of the current research of Giles, D.E.A. and Rayner, A.C., as yet unreported, has shown that each approach has the same asymptotic properties as 2 SLS derived and OLS estimates of the reduced form provided that as the number of observations tends to infinity so the number of principal components tends to the number of pre-determined variables. On that assumption one is still within the ambit of Dhrymes' lemma 5. A rationale for the choice of principal components has been provided by Amemiya (1) who has shown that in minimising the unconditional mean square forecast error one chooses the principal components of the predetermined variables corresponding to the largest roots. Two other problems of estimation remain in that (1) the reduced form developed may omit some variables; this will not affect consistency if the variables which are included are independent of error terms although a loss in the efficiency of the estimates is likely, and (2) since $Y \equiv \Sigma W_i V_i$ is not a linear combination of the estimates of

W_i, V_i a confidence interval on the forecast Y is not readily available i.e. a method for estimating a confidence interval has not been found.

Estimation

The reduced form obtained from the theoretical model given in equation (7) has a drawback in that it is an equilibrium system; static equilibrium was not a state characteristic of the New Zealand economy over the estimating period, 1952-72. Additional variables are introduced to equation (7) to provide a reduced form for estimating purposes which goes some of the way towards catching the disequilibrium effects.

Disequilibrium changes involve the adjustment of the actual capital stocks to the desired stocks over time. There is no theoretically satisfactory way of determining desired capital stocks - though distributed lag models may provide good approximations in many situations - and recognising the importance of the capital variables changing with time, it was decided to include the capital stock of each industry as well as time as indicators of disequilibrium processes in the reduced form.

Rates of the taxation of personal incomes are easily introduced into the formal model as parameters and since these rates, showing wide variation over the sample period, are expected to influence the supplies of labour they have been included in the reduced form. The opportunity cost of labour is contained in w but since the estimates are restricted to a subgroup of industries income per head of the labour forces was chosen as the proxy.

The estimated version of the reduced form obtained from equations (7) is

$$\begin{aligned} V_i &= a_i^o P + a_i^1 K + a_i^2 \tau + a_i^3 t + a_i^4 U + a_i^5 + \xi_1 \\ W_i &= b_i^o P + b_i^1 K + b_i^2 \tau + b_i^3 t + b_i^4 U + b_i^5 + \xi_2 \\ S_i &= c_i^o P + c_i^1 K + c_i^2 \tau + c_i^3 t + c_i^4 U + c_i^5 + \xi_3 \\ M_i &= d_i^o P + d_i^1 K + d_i^2 \tau + d_i^3 t + d_i^4 U + d_i^5 + \xi_4 \end{aligned} \qquad (12)$$

where i refers to an industry, all variables are measured at period t and

V_i is the number of hours worked by wage earners in industry i

W_i is the hourly wage rate, deflated by the consumer price index, in industry i

S_i is salary income in industry i

M_i is a proxy for profit income - Manufacturing Surplus - in industry i

P is the vector of the first three principal components of twenty six deflated New Zealand prices of manufactured goods

K is the vector of the first two principal components of the capital series for the twenty five industries

τ is the vector of the first three principal components of the deflated taxation series converted to an hourly rate of tax

t is time

U is the opportunity cost of labour to each industry, being the deflated per capita national income

a_j^i, b_j^i, c_j^i, d_j^i are the unknown parameters to be estimated

ξ_i is the error term.

System (12) yields a predicted value of income generated in the twenty five industries for $P = \bar{P}$

$$\hat{y} = \Sigma\hat{w}_i\hat{V}_i + \Sigma\hat{S}_i + \Sigma\hat{M}_i$$

and the predicted value of the change in income generated by a change in P is

$$d\hat{y} = \sum_i \hat{w}_i d\hat{V}_i + \sum_i \hat{V}_i d\hat{w}_i + \sum_i d\hat{S}_i + \sum_i d\hat{M}_i \tag{13}$$

A variation in the New Zealand-Australia Free Trade Agreement [2] is one source of $d\hat{y}$.

It will have been noticed that the vectors P, K, τ have been defined as the principal components respectively of all the underlying matrices of observations on prices, capital stocks and taxation. In the observation matrix on, say, taxation it is a reasonable supposition that the constituent vectors are less than fully independent of each other since government sets the tax rates. Similarly, capital stocks in different industries may be time correlated and upset the independence assumption. Deflated price vectors, the only available indicator of relative prices could also move together in some sense. The method of principal components is one way of separating out how much independence "there really is" in each of the observation matrices and by it one obtains new variables uncorrelated with each other but explaining a high proportion of the variance of the original variables. Three principal components of the price vector were chosen because they accounted for 99% of the variance in the matrix of observations

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[2] The New Zealand-Australia Free Trade Agreement, Wellington, 31 August 1965. Appendix A17 to the Journals of the House of Representatives (New Zealand) 1965 R.E. Owen, Government Printer.

on twenty six deflated prices. Two principal components of capital stocks were selected, explaining 99% of the variance in those series while 96% of the variance in the taxation series was explained by its three largest principal components. With just twenty one annual observations the principal components approach (by lowering the number of exogenous variables in the reduced form) has, as it were, the effect of improving the balance between the number of variables and the number of observations. All of the degrees of freedom have not been used up, to do so would have been to impose a less severe test of the model.

DATA

[i] Coverage

Statistics for the New Zealand Manufacturing sector have been compiled at the three digit S.I.T.C. level since 1951-2 and the series runs to 1971-2 (at the time of writing) to provide at most twenty one observations on each industry. Many series are incomplete and where this occurred the industry concerned was excluded from the study. A variety of calculations has been performed on the raw data - dividing wage bills by annual hours worked by wage earners for example - and subsidiary series often had to be built up to perform the calculations - such as annual hours worked by wage earners in each industry - which do not appear in the data presented in the appendix to this chapter. The subsidiary series often contained gaps which resulted in the elimination of additional industries from the investigation. About three-quarters of this work was done by the writer over an eight year period. A route guide through the data is now provided.

[ii] Prices Series

The conception of the study is to modify the domestic prices of goods by using the small country assumption in association with a hypothetical tariff change and following the effects through to factor incomes by industry. Detailed time series on real prices in each industry are at the centre of the work. Each industry produces many commodities so a weighted average price was struck for each industry. An industry's product was defined by the units of measurement - e.g. gallons of output for paint and varnish - so that the weighted average price reflects many components which for other purposes may be viewed as prices of differently defined commodities. Water based paints and plastic paints, both being measured in gallons provide a weighted price per gallon where the weighting is according to gallons of each. The products of an industry may not always be measured in the same units - chemical products may be measured in cwt or in gallons. In this situation the procedure was to chose the units, either cwt or gallons, which made the greatest contribution to the value of output and to use the chosen units as weights. Every price series is deflated by the March Consumer Price Index Series. The source of the price series is the "Statistics of Industrial Production", Government Printer, Wellington, for the various years.

[iii] Annual Hours Worked by Wage Earners Series

Data is available only on overtime hours worked by industry in New Zealand. But since overtime hours are defined as hours in excess of forty hours per week a straightforward calculation gives the number of hours worked. From the number of male plus the number of female wage earners, each of whom is assumed to work forty hours for forty nine weeks per year at ordinary wage rates, the ordinary hours worked per year is obtained and added to the hours of overtime worked in each industry to yield annual hours worked by industry.

[iv] Hourly Wage Rates Series

The income of wage earners in an indistry is the sum of female annual wage income and male annual wage income published in the Statistics of Industrial Production. The sums were deflated by the March Consumer Price Index series and divided by the annual hours worked, industry by industry.

[v] Salary Incomes Series

By deducting female plus male wage incomes from annual wage plus salary income in the Statistics of Industrial Production and deflating by the March Consumers Price Index one obtains real salaries in one industry for one year.

[vi] Profit or Manufacturing Surpluses Series

Data on reported profits is not published for the three digit level - Manufacturing Surplus being the proxy for profits published for each industry. It is tersely defined as

> "Surplus available to manufacturers prior to payment of dividends, taxation and other appropriations"

in the 1961-2 Statistics of Industrial Production at page vii. This data was collected and deflated for the twenty five industries for the twenty one years.

[vii] Capital Stocks Series

The Statistics of Industrial Production defines the capital stock of an industry as its Land, Buildings, Plant Machinery and Transport Equipment. The book value as at March 1951 is published as are the additions to capital stocks by year. The series of Capital Stocks contained in the appendix to this chapter was assembled by (i) depreciating the 1951 book value at 10% p.a. (straight line) then deflating the diminishing values by the Wholesale Price Index for the appropriate years. (ii) The additions for 1951-2 were deflated and depreciated then added to the depreciated, deflated March 1951 book value to give the March 1952 Capital stock for each industry. (ii) Capital stocks for 1953 were obtained from deflated and depreciated (a) 1952 additions and (b) 1953 additions. The general point is that the capital series are not merely the deflated published book values. An industry's 1972 capital stock is the sum of twenty two figures, the first being inherited capital, the second being what remains of the 1952 additions after they have been depreciated and deflated twenty one times, the third being the twenty times deflated and depreciated value of the 1953 additions etc. Similarly for each other years' capital stocks for every industry.

[viii] Personal Income Taxes Series

The C.P.I. deflated wage and salary incomes for an industry was divided by the number of employees year by year to obtain an average employee real income. An assumption was made that each employee could claim two exemptions, amounts which changed several times during the sample period and the appropriate sums were deducted to obtain a net income (in the taxation law sense of that term). The marginal tax rates were applied at the relevent increments of income to obtain the annual income tax payable on the average income. Since marginal tax rates change frequently care was taken to use each year's marginal rates. Early in the sample period surcharges were added by the government to the income tax and these have been included in the series. Additional taxation by way of the Social Security charges at 7½% have been included for those years in which it was payable as have been any rebates of tax. The annual deflated tax payable on the average employee income was then converted to an hourly rate by dividing by 1960. Such a time series was developed for each industry and is presented in the appendix to this chapter.

[ix] Labour's Opportunity Cost Series

This series is the deflated national income per head of the labour force

ESTIMATES OF EQUATIONS (12)

The tabulations which follow are the details of the O.L.S. estimates of the reduced form equations (12). The purpose of the estimate is to make a prediction so the high values of the R^2 for most equations is a happy circumstance. The generally poor standard errors are less worrisome than they would have been if the aim were to examine the correctness of the specification of a structural form. One cannot determine the structural form from the estimates because it is under identified. The Durbin-Watson Statistic is tolerably good for many equations. By and large the estimates are satisfactory particularly when one recalls that the finest possible level of diaggregation of the industrial data was selected for study.

To obtain R^2 above 0.9 for twenty of the twenty five industries salary equations is reasonably good. Thirteen R^2 above 0.9 for annual hours worked by industry is acceptable. Profit equatious, eleven R^2 above 0.9, performed as expected and even the hourly wage equations with eight R^2 exceeding 0.9 while not consistently good have a useful degree of predictive power for many three digit industries.

The sub-headings in the tabulation indicate the (standardised) endogenous variable concerned. Reading down the table, the first number in each section is the estimated coefficient of the first principal component of prices. The second number is the estimated coefficient of the second component of prices; the third number is the estimated coefficient of the third principal component of prices. The fourth and fifth numbers are respectively the estimated coefficients of the first and second principal components of the capital stocks. The sixth, seventh and eight numbers are respectively the estimates of the coefficients of the first, second and third principal components of the tax series. The second last number is the estimated coefficient of time and the final number in a section is the estimated coefficient of the opportunity cost of labour. All exogenous variables have been standardised by the factors shown in the data appendix. In the table of results running for the next 26 pages V_i, W_i, M_i, S_i are respectively the endogenous variables for hours of work by wage earners hourly wage rates, profits and salary income in industry i.

ESTIMATED REDUCED FORMS

Ordinary Least Squares Regression Equations
for the Indicated Endogenous Variables
follow for the next twenty six pages.

$V_{200}x10^{-5}$ Annual hours worked by wage earners in the Meat Feeezing and Preserving Industry

Coefficients	Standard Errors		
-0.0116	0.0154		
-0.0045	0.0056	Constant	= 459.9419
-0.0069	0.0098		
-0.0018	0.0024	R^2	= .978
-0.0008	0.0023		
0.0029	0.0034	F	= 46.5484
0.0101	0.0142	dw	= 1.6139
-0.0013	0.0425		
0.0406	0.1689		
0.0061	0.0340		

$W_{200}x10^{3}$ Hourly Wage Rates for wage earners in the Meat Freezing & Preserving Industry

0.0325	0.0213		
-0.0077	0.0077	Constant	= -472.3111
0.0358	0.0136		
0.0048	0.0033	R^2	= .92
-0.0009	0.0033		
-0.0005	0.0047	F	= 11.512
-0.0404	0.0196	dw	= 1.1256
-0.1142	0.0588		
0.5216	0.2337		
-0.0002	0.0471		

$M_{200}x10^{-4}$ Annual profits (i.e. Manufacturing Surplus) in the Meat Freezing & Preserving Industry

0.3935	0.3117		
-0.0430	0.1130	Constant	= -9427.4373
0.3051	0.1990		
0.0664	0.0489	R^2	= .404
-0.0088	0.0481		
-0.0194	0.0688	F	= .6786
-0.3988	0.2870	dw	= 2.1648
-1.2026	0.8589		
4.5543	3.4091		
-0.0998	0.6877		

$V_{205}x10^{-4}$ Annual hours worked by wage earners in the Bacon & Ham Curing Industry

0.0130	0.0126		
-0.0097	0.0045	Constant	= -424.5967
0.0083	0.0080		
-0.0020	0.0019	R^2	= .454
0.0006	0.0019		
-0.0028	0.0028	F	= 20.8444
-0.0112	0.0116	dw	= 1.9631
0.0092	0.0349		
0.2013	0.1385		
0.0357	0.0279		

$W_{205} x10^3$ Hourly Wage Rates for wage earners in the Ham and Bacon curing Industry

Coefficients	Standard Errors		
0.0208	0.0174		
-0.0019	0.0063	Constant	= -339.3136
0.0134	0.0111	R^2	= .458
0.0019	0.0027	F	= .8479
0.0028	0.0026	dw	= 2.0451
0.0008	0.0038		
-0.0152	0.0160		
-0.0658	0.0479		
0.1338	0.1904		
0.0408	0.0384		

$M_{205} x10^{-3}$ Annual profits (i.e. Manufacturing Surplus) in the Ham and Bacon curing Industry

-0.0180	0.0853		
-0.0688	0.0309	Constant	= 01303.2491
-0.0428	0.0544	R^2	= .907
-0.0165	0.0134	F	= 9.8402
-0.0016	0.0131	dw	= 2.0370
0.0057	0.0188		
0.1201	0.0785		
0.1246	0.2350		
-0.9083	0.9328		
0.3555	0.1881		

$V_{207} x10^{-3}$ Annual hours worked by wage earners in the Sausage Casings Industry

-0.0055	0.0193		
-0.0107	0.0070	Constant	= 515.044
-0.0032	0.0123	R^2	= .944
-0.0031	0.0030	F	= 17.1303
0.0062	0.0029	dw	= 1.8243
-0.0005	0.0042		
0.0171	0.0178		
0.0479	0.0534		
0.0036	0.2117		
-0.0170	0.0427		

$W_{207} x10^3$ Hourly Wage Rates for wage earners in the Sausage Casings Industry

-0.0501	0.0207		
0.0051	0.0075	Constant	= 1446.1727
-0.0340	0.0132	R^2	= .906
-0.0016	0.0032	F	= 9.604
0.0013	0.0032	dw	= 2.1773
0.0002	0.0045		
0.0288	0.0190		
0.1374	0.0571		
-0.2859	0.2268		
0.0235	0.0457		

$M_{207} x 10^{-4}$ Annual Profits (i.e. Manufacturing Surplus) in the Sausage Casings Industry

Coefficients	Standard Errors		
-0.0282	0.0232		
-0.0079	0.0084	Constant	= 374.055
-0.0165	0.0148		
-0.0063	0.0036	R^2	= .752
0.0023	0.0035		
-0.0059	0.0051	F	= 3.0417
0.0410	0.0214	dw	= 2.0233
0.1346	0.0640		
-0.3972	0.2542		
0.0677	0.0512		

$V_{232} x 10^{-4}$ Annual hours worked by wage earners in the Brewing Industry

0.0152	0.0111		
-0.0009	0.0040	Constant	=-173.5747
0.0097	0.0071		
0.0020	0.0017	R^2	= .590
-0.0006	0.0017		
0.0010	0.0024	F	= 1.4405
-0.0061	0.0102	dw	= 1.7401
-0.0353	0.0306		
0.0696	0.1217		
0.0091	0.0245		

$W_{232} x 10^{3}$ Hourly Wage Rates for wage earners in the Brewing Industry

0.0003	0.0267		
-0.0023	0.0096	Constant	= -231.9564
0.0038	0.0170		
0.0072	0.0042	R^2	= .919
0.0009	0.0041		
-0.0055	0.0059	F	= 11.4110
-0.0245	0.0246	dw	= 1.6016
-0.0372	0.0736		
0.2720	0.2923		
0.0710	0.0589		

$M_{232} x 10^{-4}$ Annual Profits (i.e. Manufacturing Surplus) in the Brewing Industry

0.1208	0.0638		
0.0384	0.0231	Constant	= -933.056
0.0644	0.0407		
-0.0017	0.0100	R^2	= .935
0.0118	0.0098		
0.0066	0.0141	F	= 14.663
-0.0085	0.0588	dw	= 2.6399
-0.1092	0.1759		
0.5240	0.6985		
-0.2084	0.1409		

$V_{236} \times 10^{-3}$ Annual hours worked by wage earners in the Aerated Waters & Cordials Industry

Coefficients	Standard Errors		
-0.0691	0.0476		
-0.0167	0.0172	Constant	= 1622.8176
-0.0363	0.0303	R^2	= .943
0.0005	0.0074	F	= 16.8448
0.0004	0.0073	dw	= 1.3494
-0.0014	0.0105		
-0.0156	0.0438		
0.0406	0.1311		
0.2757	0.5205		
0.0896	0.1050		

$W_{236} \times 10^{3}$ Hourly Wage Rates for wage earners in the Aerated Waters & Cordials Industry

0.0099	0.0068		
-0.0001	0.0024	Constant	= 72.6362
0.0023	0.0043	R^2	= .864
0.0016	0.0010	F	= 6.3993
0.0007	0.0010	dw	= 1.8645
0.0000	0.0015		
-0.0033	0.0062		
-0.0006	0.0187		
0.0506	0.0745		
0.0100	0.0150		

$M_{236} \times 10^{-3}$ Annual Profits (i.e. Manufacturing Surplus) in the Aerated Waters & Cordials Industry

-0.1131	0.0998		
-0.0889	0.0362	Constant	= -391.9798
-0.0688	0.0637	R^2	= .957
-0.0052	0.0156	F	= 22.5004
-0.0076	0.0154	dw	= 2.0374
-0.0023	0.0220		
0.0962	0.0919		
0.3877	0.2750		
-0.5524	1.0918		
0.4952	0.2202		

$V_{251} \times 10^{-4}$ Annual hours worked by wage earners in the Woollen Milling Industry

-0.0231	0.0327		
-0.0120	0.0118	Constant	= 566.2341
-0.0245	0.0208	R^2	= .968
-0.0138	0.0051	F	= 30.767
0.0107	0.0050	dw	= 2.0707
0.0055	0.0072		
0.0564	0.0301		
0.1551	0.0900		
-0.3466	0.3575		
0.0977	0.0721		

$W_{251} \times 10^3$ Hourly Wage Rates for wage earners in the Woollen Milling Industry

Coefficients	Standard Errors		
-0.0059	0.0140		
-0.0029	0.0050		
-0.0035	0.0089	Constant	= -52.8369
-0.0009	0.0022	R^2	= .849
0.0023	0.0021	F	= 5.649
-0.0029	0.0030	dw	= 2.3437
0.0112	0.0128		
0.0040	0.0385		
-0.1505	0.1530		
0.0878	0.0308		

$M_{251} \times 10^{-4}$ Annual Profits (i.e. Manufacturing Surplus) in the Woollen Milling Industry

-0.0255	0.0416		
-0.0019	0.0151	Constant	= 401.615
-0.0171	0.0266	R^2	= .465
-0.0124	0.0065	F	= 8708
0.0087	0.0064	dw	= 1.7768
0.0124	0.0092		
0.0372	0.0383		
0.0195	0.1148		
-0.4314	0.4558		
0.0736	0.0919		

$V_{260} \times 10^{-4}$ Annual hours worked by wage earners in the Hosiery and other Knitting mills

-0.0396	0.0326		
0.0051	0.0118	Constant	= 1468.6993
-0.0254	0.0208	R^2	= .947
-0.0055	0.0051	F	= 17.9828
0.0044	0.0050	dw	= 2.3310
0.0105	0.0072		
0.0291	0.0300		
0.0152	0.0898		
-0.1978	0.3566		
0.0283	0.0719		

$W_{260} \times 10^3$ Hourly Wage Rates for wage earners in the Hosiery and other Knitting mills

-0.0665	0.0692		
0.0122	0.0251	Constant	= 2346.6814
-0.0490	0.0442	R^2	= .453
-0.0175	0.0108	F	= .8295
0.0003	0.0107	dw	= 1.7373
0.0140	0.0153		
0.0797	0.0637		
0.1710	0.1908		
-0.8565	0.7575		
-0.0178	0.1528		

$M_{260} x 10^{-4}$ Annual Profits (i.e. Manufacturing Suprlus) in the Hosiery and other Knitting Mills

Coefficients	Standard Errors		
0.0331	0.0312		
0.0130	0.0113	Constant	= 275.0344
0.0151	0.0199	R^2	= .8857
-0.0037	0.0049	F	= 7.7513
0.0045	0.0048	dw	= 2.8712
-0.0046	0.0069		
-0.0004	0.0287		
-0.0112	0.0861		
0.2058	0.3418		
-0.1253	0.0689		

$V_{262} x 10^{-3}$ Annual hours worked by wage earners in the Hosiery and other Knitting Mills

0.0248	0.0295		
-0.0061	0.0107	Constant	= -64.5981
0.0065	0.0188	R^2	= .8323
-0.0002	0.0046	F	= 4.9634
0.0011	0.0045	dw	= 2.4367
-0.0017	0.0065		
0.0097	0.0272		
0.0234	0.0815		
-0.0886	0.3235		
-0.0243	0.0652		

$W_{262} x 10^{3}$ Hourly Wage Rates for wage earners in the Hosiery and other Knitting Mills

-0.0069	0.0175		
0.0000	0.0063	Constant	= 624.2117
0.0135	0.0112	R^2	= .5275
-0.0003	0.0027	F	= .5275
0.0021	0.0027	dw	= 1.7569
-0.0004	0.0038		
0.0156	0.0161		
0.0525	0.0484		
-0.1271	0.1923		
-0.0100	0.0388		

$M_{262} x 10^{-3}$ Annual Profits (i.e. Manufacturing Surplus) in the Hosiery and other Knitting Mills

0.0313	0.0163		
0.0033	0.0059	Constant	= -173.7685
0.0151	0.0104	R^2	= .829
0.0037	0.0025	F	= 4.8539
0.0039	0.0025	dw	= 1.7896
0.0049	0.0036		
-0.0058	0.0150		
-0.0263	0.0451		
0.0955	0.1793		
-0.0690	0.0361		

$V_{263} x10^{-3}$ Annual hours worked by wage earners in the Linen Flax Industry

Coefficients	Standard Errors		
-0.0080	0.0207		
-0.0007	0.0075	Constant	= 332.6852
-0.0063	0.0132	R^2	= .926
-0.0021	0.0032	F	= 12.5826
0.0053	0.0032	dw	= 1.2094
0.0005	0.0045		
0.0397	0.0191		
0.0587	0.0571		
-0.4864	0.2268		
0.0263	0.0457		

$W_{263} x10^{3}$ Hourly Wage Rates for wage earners in the Linen Flax Industry

0.0377	0.0134		
-0.0152	0.0048	Constant	= -829.0391
0.0312	0.0086	R^2	= .871
0.0041	0.0021	F	= 6.8023
-0.0053	0.0020	dw	= 2.3608
-0.0013	0.0029		
-0.0563	0.0124		
-0.1322	0.0371		
0.6418	0.1473		
0.0112	0.0297		

$M_{263} x10^{-3}$ Annual Profits (i.e. Manufacturing Surplus) in the Linen Flax Industry

-0.0115	0.0207		
0.0102	0.0075	Constant	= 102.3909
-0.0012	0.0132	R^2	= .393
-0.0021	0.0032	F	= .6494
0.0026	0.0032	dw	= 2.1825
0.0051	0.0045		
0.0104	0.0191		
-0.0104	0.0572		
-0.1982	0.2272		
0.0396	0.0458		

$V_{27+} x10^{5}$ Annual hours worked by wage earners in the Clothing Industry

-0.0299	0.0098		
0.0074	0.0035	Constant	= 857.3744
-0.0169	0.0063	R^2	= .8633
-0.0033	0.0015	F	= 6.4836
0.0029	0.0015	dw	= 2.2122
0.0034	0.0021		
0.0268	0.0091		
0.0722	0.0272		
-0.3280	0.1081		
0.0408	0.0218		

$W_{27+} \times 10^{-3}$ Hourly Wage Rates for wage earners in the Clothing Industry

Coefficients	Standard Errors
0.0031	0.0039
0.0007	0.0014
0.0041	0.0025
0.0004	0.0006
0.0007	0.0006
0.0017	0.0008
-0.0053	0.0036
-0.0057	0.0110
0.0987	0.0436
-0.0061	0.0088

Constant = 184.4673
R^2 = .985
F = 69.9446
dw = 1.7265

$M_{27+} \times 10^{-4}$ Annual Profits (i.e. Manufacturing Surplus) in the Clothing Industry

Coefficients	Standard Errors
0.0496	0.0393
0.0295	0.0142
0.0496	0.0251
-0.0005	0.0061
0.0033	0.0060
0.0082	0.0086
-0.0188	0.0362
-0.1176	0.1083
0.1544	0.4300
0.0393	0.0867

Constant = -831.5562
R^2 = .905
F = 9.5518
dw = 3.0432

$V_{300} \times 10^{-4}$ Annual hours worked by wage earners in the Clothing Industry

Coefficients	Standard Errors
-0.0124	0.0712
-0.0287	0.0258
-0.0107	0.0454
-0.0076	0.0111
0.0000	0.0110
-0.0110	0.0157
-0.0066	0.0655
0.0602	0.1962
0.2452	0.7789
-0.0288	0.1571

Constant = 1373.0115
R^2 = .372
F = .5933
dw = 2.8980

$W_{300} \times 10^{3}$ Hourly Wage Rates for wage earners in the Clothing Industry

Coefficients	Standard Errors
-0.0101	0.0359
0.0095	0.0130
0.0074	0.0229
0.0002	0.0056
0.0000	0.0055
0.0033	0.0079
0.0027	0.0331
-0.0327	0.0991
-0.1530	0.3934
0.0845	0.0793

Constant = 182.2522
R^2 = .38164
F = .6172
dw = 3.2302

$M_{300} \times 10^{-4}$ Annual Profits (i.e. Manufacturing Surplus) in the Clothing Industry

Coefficients	Standard Errors		
-0.0532	0.0206		
0.0066	0.0075	Constant	= 843.6056
-0.0372	0.0132		
-0.0087	0.0032	R^2	= .943
0.0048	0.0031		
-0.0042	0.0045	F	= 16.6868
0.0855	0.0190	dw	= 2.4521
0.2253	0.0569		
-0.8861	0.2261		
0.1182	0.0456		

$V_{360} \times 10^{-5}$ Annual hours worked by wage earners in the Motor Vehicle Tyres and Tubes Industry

-0.0062	0.0094		
0.0058	0.0034	Constant	= -48.9001
0.0030	0.0060		
0.0004	0.0014	R^2	= .8953
-0.0007	0.0014		
0.0025	0.0020	F	= 8.5523
-0.0095	0.0087	dw	= 1.9208
-0.0275	0.0260		
0.0310	0.1035		
0.0504	0.0208		

$W_{360} \times 10^{3}$ Hourly Wage Rates for wage earners in the Motor Vehicle Tyres and Tubes Industry

-0.0365	0.0320		
-0.0089	0.0116	Constant	= 825.1213
-0.0186	0.0204		
-0.0017	0.0050	R^2	= .9533
-0.0040	0.0049		
-0.0075	0.0070	F	= 20.4175
0.0141	0.0294	dw	= 2.4646
0.0282	0.0882		
-0.0013	0.3502		
0.0653	0.0706		

$M_{360} \times 10^{-3}$ Annual Profits (i.e. Manufacturing Surplus) in the Motor Vehicle Tyres and Tubes Industry

-0.1498	0.3345		
0.0820	0.1213	Constant	= 1119.2141
-0.0551	0.2135		
-0.0656	0.0525	R^2	= .6333
0.0289	0.0517		
0.0118	0.0739	F	= 1.7271
0.1666	0.3080	dw	= 2.4176
0.2702	0.9217		
-2.3353	3.6586		
0.7018	0.7380		

$V_{363} x10^{-4}$ Annual Hours worked by wage earners in the Rubber Goods (other than Motor Vehicle Tyres & Tubes) Industry

Coefficients	Standard Errors		
-0.0198	0.0124		
0.0059	0.0045	Constant	= 297.9613
-0.0025	0.0079		
-0.0046	0.0019	R^2	= .9640
0.0032	0.0019		
0.0069	0.0027	F	= 26.8540
0.0159	0.0114	dw	= 1.7868
-0.0164	0.0343		
-0.2036	0.1364		
0.0774	0.0275		

$W_{363} x10^{3}$ Hourly Wage Rates for wage earners in the Rubber Goods (other than Motor Vehicle Tyres & Tubes) Industry

-0.1595	0.1078		
0.0170	0.0391	Constant	= 4743.7639
-0.1112	0.0688		
-0.0301	0.0169	R^2	= .4064
0.0006	0.0166		
0.0216	0.0238	F	= .6849
0.1636	0.0993	dw	= 2.2367
0.4183	0.2972		
-1.7397	1.1796		
-0.0073	0.2379		

$M_{363} x10^{-3}$ Annual Profits (i.e. Manufacturing Surplus) in the Rubber Goods (other than Motor Vehicle Tyres and Tubes) Industry

-0.1077	0.0963		
0.0118	0.0349	Constant	= 2154.8411
-0.0779	0.0615		
-0.0410	0.0151	R^2	= .8535
0.0103	0.0148		
-0.0145	0.0212	F	= 5.8304
0.1872	0.0887	dw	= 1.8491
0.5025	0.2654		
-1.8558	1.0537		
0.2371	0.2125		

$V_{366} x10^{-4}$ Annual Hours worked by wage earners in the Vulcanising & Tyre Retreading Industry

-0.0017	0.0062		
0.0008	0.0022	Constant	= 110.0728
-0.0014	0.0040		
-0.0005	0.0009	R^2	= .9427
-0.0010	0.0009		
0.0021	0.0013	F	= 16.4603
0.0017	0.0057	dw	= 2.7454
-0.0176	0.0173		
0.0027	0.0687		
0.0021	0.0138		

$M_{366} x10^{-3}$ Annual Profits (i.e. Manufacturing Surplus) in the Vulcanising & Tyre Retreading Industry

Coefficients	Standard Errors		
-0.3019	0.1253		
-0.0537	0.0454		
-0.2029	0.0800	Constant	= 4573.6665
-0.0174	0.0196	R^2	= .9418
-0.0149	0.0193		
-0.0093	0.0276	F	= 16.2054
0.2718	0.1154	dw	= 2.0663
0.6914	0.3453		
-2.4788	1.3707		
0.4136	0.2765		

$V_{370} x10^{-4}$ Annual hours worked by wage earners in the Chemical Fertilizer Industry

0.0308	0.0303		
-0.0008	0.0110		
0.0165	0.0193	Constant	= -626.3710
0.0008	0.0047	R^2	= .4396
0.0054	0.0046		
-0.0007	0.0067	F	= .7846
-0.0194	0.0279	dw	= 2.2482
-0.0628	0.0836		
0.2000	0.3320		
0.0241	0.0669		

$W_{370} x10^{3}$ Hourly Wage Rates for wage earners in the Chemical Fertilizer Industry

0.1004	0.0751		
-0.0147	0.0272		
0.0667	0.0479	Constant	= -1815.7792
-0.0081	0.0118	R^2	= .7750
-0.0137	0.0116		
0.0121	0.0165	F	= 3.4445
-0.0624	0.0691	dw	= 1.8021
-0.3877	0.2069		
0.6641	0.8214		
0.0035	0.1657		

$M_{370} x10^{-3}$ Annual Profits (i.e. Manufacturing Surplus) in the Chemical Fertilizer Industry

-0.1219	0.3829		
0.1782	0.1389		
0.0288	0.2444	Constant	= 3374.5658
-0.0102	0.0601	R^2	= .767
-0.0381	0.0591		
0.2136	0.0846	F	= 3.2988
0.1822	0.3526	dw	= 2.2559
0.3925	1.0551		
-2.4617	4.1879		
0.2700	0.8448		

$V_{372} \times 10^{-3}$ Annual hours worked by wage earners in the Vegetable & Animal Oils & Fats Industry

Coefficients	Standard Errors
-0.0309	0.0317
-0.0055	0.0115
0.0107	0.0202
-0.0122	0.0049
0.0017	0.0049
0.0144	0.0070
0.0000	0.0292
-0.0295	0.0873
-0.0736	0.3468
0.0568	0.0699

Constant = 1178.1330
R^2 = .8245
F = 4.7
dw = 2.1821

$W_{372} \times 10^{3}$ Hourly Wage Rates for wage earners in the Vegetable & Annimal Oils and Fats Industry

-0.0040	0.0122
0.0036	0.0044
-0.0101	0.0078
0.0035	0.0019
0.0000	0.0018
-0.0033	0.0027
0.0048	0.0113
0.0383	0.0338
0.0101	0.1342
-0.0048	0.0270

Constant = 499.2719
R^2 = .9463
F = 17.655
dw = 2.7265

$M_{372} \times 10^{-3}$ Annual Profits (i.e. Manufacturing Surplus) in the Vegetable & Animal Oils & Fats Industry

-0.0663	0.0330
-0.0203	0.0119
-0.0350	0.0210
-0.0076	0.0051
-0.0144	0.0051
0.0015	0.0073
0.0790	0.0304
0.1329	0.0910
-0.8731	0.3613
0.1877	0.0729

Constant = 779.0239
R^2 = 0.9
F = 9.0337
dw = 2.4814

$V_{377} \times 10^{-3}$ Annual hours worked by wage earners in the Vegetable & Animal Oils & Fats Industry

-0.0832	0.0452
0.0098	0.0163
-0.0173	0.0288
-0.0127	0.0071
0.0089	0.0069
0.0073	0.0099
0.0927	0.0416
0.1409	0.1245
-1.2818	0.4943
0.1819	0.0997

Constant = 767.6464
R^2 = .7087
F = 2.4336
dw = 2.4452

$W_{377} x10^3$ - Hourly wage rates for wage earners in the soap industry

Coefficients	Standard Errors		
0.0228	0.0515		
0.0323	0.0186		
0.0218	0.0329	Constant	= 767.6464
0.0051	0.0081	R^2	= .7087
-0.0045	0.0079	F	= 2.4336
0.0336	0.0113	dw	= 2.4262
-0.0231	0.0474		
-0.1240	0.1420		
0.2478	0.5637		
-0.1346	0.1137		

$M_{377} x10^{-3}$ - Annual profits in the soap industry

0.1093	0.2150		
-0.0391	0.0779		
0.0946	0.1372	Constant	=2555.2475
0.0131	0.0337	R^2	= . 620
0.0245	0.0332	F	= 1.6327
-0.0083	0.0475	dw	= 1.6338
-0.2131	0.1979		
-0.4972	0.5923		
2.6251	2.3512		
-0.0669	0.4742		

$V_{380} x10^{-5}$ - Annual hours worked by wage earners in the Paints and Varnish Industry

-0.0122	0.0066		
0.0020	0.0024		
-0.0030	0.0042	Constant	= 274.1801
-0.0013	0.0010	R^2	= .7489
0.0002	0.0010	F	= 2.9839
0.0007	0.0014	dw	= 2.2839
0.0005	0.0061		
0.0021	0.0184		
-0.0623	0.0731		
0.0243	0.0147		

$W_{380} x10^3$ - Hourly wage rates for wage earners in the Paints and Varnish Industry

0.0153	0.0109		
0.0043	0.0039		
0.0004	0.0070	Constant	= 8.7982
0.0039	0.0017	R^2	= .9703
0.0003	0.0016	F	= 32.7298
-0.0000	0.0024	dw	= 2.0673
-0.0197	0.0100		
-0.0360	0.0302		
0.2680	0.1199		
-0.0103	0.0241		

$M_{380} \times 10^{-3}$ - Annual profits in the Pharmaceuticals, Toilet Goods and Cosmetics industry

Coefficients	Standard Errors		
-0.4852	0.2700		
-0.0290	0.0979		
-0.2942	0.1724	Constant	= 8050.4077
-0.0407	0.0424	R^2	= .8355
-0.0138	0.0417	F	= 5.0804
0.0174	0.0596	dw	= 1.2859
0.3482	0.2486		
1.0247	0.7440		
-3.5291	2.9531		
0.6170	0.5957		

$V_{383} \times 10^{-5}$ - Annual hours worked by wage earners in the Pharmaceuticals, Toilet Goods and Cosmetics industry

Coefficients	Standard Errors		
-0.0076	0.0079		
0.0015	0.0028	Constant	= 173.5697
-0.0047	0.0050	R^2	= .9770
-0.0014	0.0012	F	= 42.5447
0.0020	0.0012	dw	= 1.4429
-0.0001	0.0017		
0.0152	0.0072		
0.0251	0.0218		
-0.1080	0.0865		
0.0223	0.0174		

$W_{383} \times 10^{3}$ - Hourly wage rates for wage earners in the Pharmaceuticals, Toilet Goods and Cosmetics industry

Coefficients	Standard Errors		
0.0149	0.0123		
0.0013	0.0044		
0.0087	0.0079	Constant	= 330.5457
0.0047	0.0019	R^2	= .7916
-0.0007	0.0019	F	= 3.7985
-0.0032	0.0027	dw	= 2.6409
-0.0187	0.0114		
-0.0278	0.0341		
0.2897	0.1354		
-0.0752	0.0273		

$M_{383} \times 10^{-3}$ - Annual profits in the Pharmaceuticals, Toilet Goods and Cosmetics industry

Coefficients	Standard Errors		
-0.0882	0.15[illegible]2		
0.0603	0.05[illegible]5		
-0.0739	0.0978	Constant	= 4201.2686
-0.0183	0.0240	R^2	= .9504
0.0010	0.0236	F	= 19.1716
0.0071	0.0338	dw	= 2.2477
0.2552	0.1410		
0.5671	0.4221		
-1.6438	1.6756		
-0.1600	0.3380		

$V_{389} x 10^{-5}$ - Annual hours worked by wage earners in the Chemical Products Industry n.e.i.

Coefficients	Standard Errors
0.0024	0.0068
-0.0033	0.0024
-0.0012	0.0043
0.0000	0.0010
0.0027	0.0010
-0.0023	0.0015
0.0024	0.0063
0.0121	0.0189
0.0633	0.0752
0.0064	0.0151

Constant = 56.9383
R^2 = .9831
F = 58.4685
dw = 2.4170

$W_{389} x 10^{3}$ - Hourly wage rates for wage earners in the Chemical Products Industry n.e.i.

0.0066	0.0113
0.0066	0.0041
0.0073	0.0072
0.0028	0.0017
-0.0015	0.0017
0.0040	0.0025
-0.0124	0.0104
-0.0497	0.0311
0.1182	0,1237
0.0122	0.0249

Constant = 98.2697
R^2 = .9085
F = 9.9393
dw = 1.6533

$M_{389} x 10^{-3}$ - Annual profits in the Chemical Products Industry n.e.i.

-0.0157	0.3448
-0.0183	0.1250
-0.0470	0.2201
0.0047	0.0541
0.0363	0.0533
-0.0535	0.0761
0.2074	0.3175
0.4440	0.9501
-0.8578	3.7712
0.2715	0.7607

Constant = 875.4409
R^2 = .8739
F = 6.9308
dw = 2.706

$V_{390} x 10^{-3}$ - Annual hours worked by wage earners in the Petroleum and Coal Production Industry

-0.0122	0.0300
0.0091	0.0108
-0.0122	0.0191
-0.0099	0.0047
0.0073	0.0046
0.0047	0.0066
0.0596	0.0276
0.0627	0.0827
-0.3940	0.3283
0.0212	0.0662

Constant = 573.0690
R^2 = .9715
F = 34.1375
dw = 2.5050

$W_{390} \times 10^3$ - Hourly wage rates for wage earners in the Petroleum and Coal Production industry

Coefficients	Standard Errors
-0.0991	0.0963
0.0221	0.0349
-0.0704	0.0614
-0.0243	0.0151
-0.0013	0.0148
0.0169	0.0212
0.1261	0.0886
0.2613	0.2653
-1.3898	1.0531
0.0155	0.2124

Constant = 3228.4325
R^2 = .4333
F = .7648
dw = 1.7607

$M_{390} \times 10^{-3}$ - Annual profits in the Petroleum and Coal Production Industry

Coefficients	Standard Errors
-0.4059	0.2387
0.0457	0.0865
-0.2953	0.1524
-0.0459	0.0375
0.0107	0.0369
0.0164	0.0527
0.6908	0.2198
0.8370	0.6577
-5.8122	2.6107
0.3984	0.5266

Constant = 7955.8086
R^2 = .9712
F = 33.7406
dw = 2.2713

$V_{393} \times 10^{-3}$ - Annual hours worked by wage earners in the Bituminous and Coal Products Industry

Coefficients	Standard Errors
0.0475	0.0287
-0.0086	0.0104
0.0341	0.0183
-0.0005	0.0045
-0.0003	0.0044
0.0034	0.0063
-0.0503	0.0264
-0.1298	0.0791
0.6604	0.3142
0.0291	0.0633

Constant = 1137.7728
R^2 = .9398
F = 15.6204
dw = 1.5992

$W_{393} \times 10^3$ - Hourly wage rates for wage earners in the Bituminous and Coal Products Industry

Coefficients	Standard Errors
-0.0014	0.0291
0.0014	0.0105
0.0008	0.0186
0.0035	0.0045
0.0045	0.0045
-0.0050	0.0064
0.0039	0.0268
0.0186	0.0802
-0.0406	0.3186
0.0626	0.0642

Constant = 10.8459
R^2 = .8016
F = 4.0424
dw = 1.8976

$M_{393}x10^{-3}$ - Annual profits in the Bituminous and Coal Products Industry

Coefficients	Standard Errors			
-0.0593	0.0584			
0.0007	0.0211			
-0.0394	0.0372			
-0.0090	0.0091	Constant	=	1285.5065
-0.0017	0.0090	R^2	=	.8389
0.0057	0.0129	F	=	5.2086
0.0665	0.0537	dw	=	1.5296
0.1804	0.1609			
-0.5611	0.6387			
0.0564	0.1288			

$V_{450}x10^{-4}$ - Annual hours worked by wage earners in the Range Making Industry

0.0015	0.0089			
0.0026	0.0032			
-0.0015	0.0057	Constant	=	210.8228
0.0001	0.0014	R^2	=	.5914
0.0038	0.0013	F	=	1.4477
0.0015	0.0019	dw	=	2.2708
0.0010	0.0082			
-0.0021	0.0246			
-0.0129	0.0978			
-0.0065	0.0197			

$W_{450}x10^{3}$ - Hourly wage rates for wage earners in the Range Making Industry

0.0080	0.0098			
0.0002	0.0035			
0.0079	0.0062			
0.0012	0.0015	Constant	=	19.4395
0.0014	0.0015	R^2	=	.8797
0.0000	0.0021	F	=	7.3143
-0.0082	0.0090	dw	=	2.9692
-0.0125	0.0271			
0.0801	0.1078			
0.0328	0.0217			

$M_{450}x10^{-3}$ - Annual profits in the Range Making Industry

-0.0400	0.0775			
-0.0200	0.0281			
-0.0539	0.0495			
0.0406	0.0121	Constant	=	300.9340
0.0396	0.0119	R^2	=	.8110
0.0159	0.0171	F	=	4.2911
0.1208	0.0714	dw	=	3.0757
0.2022	0.2137			
-1.4450	0.8483			
0.3623	0.1711			

$V_{455}x10^{-4}$ - Annual hours worked by wage earners in the Radio and T.V. Assembly Industry

Coefficients	Standard Errors			
0.7627	0.9390			
0.1989	0.3405			
0.4019	0.5994			
0.0673	0.1475	Constant		-4149.0359
0.0999	0.1451	R^2	=	.2842
0.0139	0.2074	F	=	.3972
-0.3398	0.8645	dw	=	2.2719
-1.1696	2.5870			
5.5435	10.2681			
-2.0470	2.0713			

$W_{455}x10^{3}$ - Hourly wage rates for wage earners in the Radio and T.V. Assembly Industry

0.0392	0.0231			
-0.0058	0.0083			
0.0282	0.0147			
0.0034	0.0036	Constant	=	-833.0610
-0.0005	0.0035	R^2	=	.6648
0.0048	0.0051	F	=	1.9837
-0.0337	0.0213	dw	=	2.2472
-0.1701	0.0637			
0.3540	0.2530			
0.0314	0.0510			

$M_{455}x10^{-3}$ - Annual profits in the Radio and T.V. Assembly Industry

-0.4381	0.9096			
-0.3130	0.3299			
-0.3721	0.5806			
-0.1016	0.1429	Constant	=	-203.0734
-0.0479	0.1406	R^2	=	.7439
-0.0347	0.2009	F	=	2.9051
0.7701	0.8375	dw	=	2.0170
4.7478	2.5060			
-6.4702	9.9468			
1.8208	2.0065			

$V_{459}x10^{-4}$ - Annual hours worked by wage earners in the Electrical Machinery Industry

-0.0375	0.0423			
0.0120	0.0153	Constant	=	476.8937
-0.0299	0.0270	R^2	=	.9849
-0.0079	0.0066	F	=	65.5533
0.0112	0.0065	dw	=	1.8919
0.0065	0.0093			
0.1256	0.0390			
0.1783	0.1167			
-0.9754	0.4634			
0.1574	0.0934			

$W_{459} x 10^3$ - Hourly wage rates for wage earners in the Electrical Machinery Industry

Coefficients	Standard Errors
0.0083	0.0074
-0.0010	0.0027
0.0041	0.0047
0.0028	0.0011
0.0006	0.0011
-0.0010	0.0016
-0.0107	0.0068
-0.0100	0.0205
0.1543	0.0815
0.0048	0.0164

Constant = 82.8660
R^2 = .956
F = 21.7720
dw = 1.7814

$M_{459} x 10^{-4}$ - Annual profits in the Electrical Machinery Industry

0.0495	0.0469
0.0296	0.0170
0.0253	0.0299
-0.0076	0.0073
0.0080	0.0072
0.0031	0.0103
0.0173	0.0432
0.0249	0.1293
0.0572	0.5135
-0.0830	0.1036

Constant = -181.1567
R^2 = .9386
F = 15.3006
dw = 2.3972

$V_{330} x 10^{-4}$ - Annual hours worked by wage earners in the Pulp, Paper and Paperboard Industry

0.0287	0.0227
-0.0051	0.0082
0.0285	0.0145
0.0043	0.0035
-0.0064	0.0035
-0.0022	0.0050
-0.0603	0.0209
-0.1073	0.0627
0.8656	0.2491
0.0343	0.0502

Constant = -920.8094
R^2 = .9885
F = 86.2145
dw = 2.4493

$W_{330} x 10^3$ - Hourly wage rates for wage earners in the Pulp, Paper and Paperboard Industry

-0.0418	0.0280
0.0037	0.0101
-0.0226	0.0179
-0.0008	0.0044
0.0006	0.0043
0.0016	0.0061
0.0097	0.0258
0.0997	0.0772
-0.0991	0.3067
0.0949	0.0618

Constant = 8184.2053
R^2 = .9421
F = 16.2822
dw = 1.8522

$M_{330} x 10^{-3}$ - Annual profits in the Pulp, Paper and Paperboard Industry

Coefficients	Standard Errors
-1.0093	0.4982
-0.0491	0.1807
-0.6767	0.3180
-0.3190	0.0783
0.0994	0.0770
0.0365	0.1100
1.4117	0.4587
3.8065	1.3727
-10.3082	5.4486
-0.1890	1.0991

Constant = 29556.3082
R^2 = .9627
F = 25.8228
dw = 2.2915

$S_{200} x 10^{-4}$ (000)- Pulp, Paper and Paperboard Industry

-0.0364	0.0199
0.0031	0.0072
-0.0251	0.0127
-0.0034	0.0031
0.0011	0.0030
0.0024	0.0044
0.0385	0.0183
0.1124	0.0549
-0.2929	0.2179
0.0138	0.0439

Constant = 974.3446
R^2 = .9583
F = 22.9903
dw = 2.1883

$S_{205} x 10^{-3}$ (000) - Pulp, Paper and Paperboard Industry

0.0075	0.0118
-0.0094	0.0043
0.0040	0.0075
-0.0040	0.0018
0.0021	0.0018
-0.0013	0.0026
0.0028	0.0109
0.0252	0.0327
0.0941	0.1300
0.0206	0.0262

Constant = 144.2140
R^2 = .9701
F = 32.5145
dw = 1.6362

$S_{207} x 10^{-3}$ (000) Sausage Casings

-0.0025	0.0043
0.0007	0.0015
-0.0020	0.0027
0.0006	0.0006
0.0005	0.0006
-0.0001	0.0009
0.0036	0.0039
0.0075	0.0118
-0.0289	0.0470
-0.0063	0.0094

Constant = 112.5569
R^2 = .8015
F = 4.0386
dw = 1.7086

$S_{232} \times 10^{-3}$(000) Brewing of Ale and Stout, and Malting

Coefficients	Standard Errors
0.0109	0.0189
0.0052	0.0068
0.0049	0.0121
0.0028	0.0029
0.0015	0.0029
0.0000	0.0041
0.0223	0.0174
0.0377	0.0523
-0.0851	0.2076
0.0064	0.0418

Constant = -40.0532
R^2 = .9707
F = 33.1953
dw = 2.4613

$S_{236} \times 10^{-3}$(000) Aerated Waters and Cordial

-0.0022	0.0090
-0.0076	0.0032
0.0000	0.0057
0.0005	0.0014
0.0009	0.0013
-0.0019	0.0019
-0.0039	0.0083
-0.0019	0.0249
0.1072	0.0988
0.0355	0.0199

Constant = -119.4876
R^2 = .9758
F = 40.3949
dw = 1.7666

$S_{251} \times 10^{-3}$(000) Woollen Milling

-0.0213	0.0146
0.0016	0.0053
-0.0120	0.0093
-0.0011	0.0022
0.0041	0.0022
0.0027	0.0032
0.0399	0.0134
0.0560	0.0402
-0.2750	0.1599
0.0739	0.0322

Constant = 199.6596
R^2 = .9915
F = 116.6897
dw = 1.6920

$S_{260} \times 10^{-3}$(000) Hosiery and Other Knitting Mills

-0.0413	0.0391
0.0016	0.0141
-0.0210	0.0249
-0.0007	0.0061
-0.0015	0.0060
-0.0026	0.0086
0.0382	0.0360
0.1353	0.1078
-0.1964	0.4280
0.0733	0.0863

Constant = 799.7080
R^2 = .9646
F = 27.3071
dw = 2.0057

$S_{262}x10^{-2}(000)$ Phorium Flax

Coefficients	Standard Errors			
0.0058	0.0325			
0.0062	0.0118			
0.0004	0.0208			
0.0001	0.0051	Constant	=	172.0261
-0.0036	0.0050	R^2	=	.6139
-0.0009	0.0072	F	=	1.5903
-0.0124	0.0300	dw	=	1.4480
-0.0249	0.0898			
0.0714	0.3564			
-0.0099	0.0719			

$S_{263}x10^{-2}(000)$ Linen Flax

0.0103	0.0178			
-0.0056	0.0064			
0.0062	0.0113			
0.0023	0.0028	Constant	=	-359.9550
-0.0011	0.0027	R^2	=	.7317
-0.0019	0.0039	F	=	2.7279
-0.0042	0.0164	dw	=	2.1565
-0.0177	0.0491			
0.0108	0.1949			
0.0287	0.0393			

$S_{27+}x10^{-4}(000)$ Feeds for Animals and Fowls

-0.0112	0.0083			
-0.0022	0.0030			
-0.0065	0.0053			
-0.0034	0.0013	Constant	=	360.7402
0.0009	0.0012	R^2	=	.9607
0.0017	0.0018	F	=	24.4725
0.0120	0.0077	dw	=	2.2325
0.0354	0.0230			
-0.0875	0.0915			
0.0291	0.0184			

$S_{300}x10^{-4}(000)$ Sawmills

-0.0015	0.0124			
-0.0017	0.0045			
0.0003	0.0079			
0.0013	0.0019	Constant	=	45.1753
0.0001	0.0019	R^2	=	.4673
0.0000	0.0027	F	=	.8774
-0.0043	0.0114	dw	=	2.3407
-0.0158	0.0342			
-0.0274	0.1369			
0.0279	0.0274			

$S_{330} x10^{-3} (000)$ Pulp, Paper and Paperboard

Coefficients	Standard Errors			
-0.0602	0.0480			
-0.0100	0.0174			
-0.0250	0.0306			
0.0033	0.0075	Constant	=	325.0486
-0.0098	0.0074	R^2	=	.9919
-0.0113	0.0106	F	=	123.6741
0.0322	0.0442	dw	=	2.7152
0.2123	0.1322			
0.2956	0.5249			
0.1303	0.1059			

$S_{360} x10^{-3} (000)$ Motorvehicle Tyres and Tubes

0.0042	0.0088			
-0.0092	0.0031	Constant	=	-112.7300
0.0035	0.0056	R^2	=	.9900
0.0030	0.0013	F	=	100.0027
-0.0050	0.0013	dw	=	1.8757
-0.0042	0.0019			
-0.0034	0.0081			
0.0113	0.0242			
0.1861	0.0963			
0.0097	0.0194			

$S_{363} x10^{-3} (000)$ Rubber Goods (Other than Motor-vehicle Tyres and Tubes)

0.0231	0.0141			
0.0012	0.0051	Constant	=	-547.3258
0.0192	0.0090	R^2	=	.9906
0.0030	0.0022	F	=	106.2633
0.0010	0.0021	dw	=	2.1540
0.0012	0.0031			
-0.0033	0.0130			
-0.0335	0.0389			
0.2257	0.1546			
0.0154	0.0311			

$S_{366} x10^{-3} (000)$ Vulcanising and Tyre Retreading

0.0207	0.0141			
-0.0063	0.0051			
0.0140	0.0090			
0.0021	0.0022			
-0.0010	0.0021	Constant	=	-443.7406
-0.0037	0.0031	R^2	=	.9147
-0.0353	0.0130	F	=	10.7262
-0.0840	0.0389	dw	=	1.3956
0.4421	0.1544			
-0.0065	0.0311			

$S_{370}x10^{-3}(000)$ Chemical Fertilisers

Coefficients	Standard Errors		
-0.0144	0.0134		
0.0009	0.0048	Constant	= 85.9183
-0.0064	0.0086		
-0.0008	0.0021	R^2	= .9784
-0.0038	0.0020	F	= 45.4721
0.0011	0.0029	dw	= 2.8151
0.0155	0.0124		
0.0523	0.0371		
-0.1081	0.1474		
0.0657	0.0297		

$S_{372}x10^{-1}(000)$ Vegetable and Animal Oils and Fats

-0.0081	0.0045		
-0.0030	0.0016		
-0.0040	0.0029		
-0.0014	0.0007	Constant	= 187.3197
0.0016	0.0007		
0.0002	0.0010	R^2	= .9502
0.0009	0.0042	F	= 19.0905
0.0119	0.0125	dw	= 2.3192
0.0083	0.0499		
0.0105	0.0100		

$S_{377}x10^{-3}(000)$ Soap

0.0067	0.0143		
0.0053	0.0052		
0.0092	0.0091		
0.0065	0.0022	Constant	= 27.6357
-0.0029	0.0022		
-0.0003	0.0031	R^2	= .9351
-0.0212	0.0132	F	= 14.4203
-0.0602	0.0395	dw	= 2.8121
0.2647	0.1568		
-0.0268	0.0316		

$S_{380}x10^{-3}(000)$ Paint and Varnish

-0.0016	0.0182		
-0.0021	0.0066		
0.0080	0.0116		
-0.0056	0.0028	Constant	= 97.2857
0.0000	0.0028		
0.0027	0.0040	R^2	= .9832
-0.0078	0.0168	F	= 58.7515
-0.0058	0.0503	dw	= 2.0111
0.2472	0.1999		
0.0190	0.0403		

$S_{383}x10^{-3}$(000) Pharmaceuticals, Toilet Goods and Cosmetics

Coefficients	Standard Errors		
-0.0077	0.0114	Constant	= 30.5852
-0.0008	0.0041		
-0.0040	0.0072	R^2	= .9934
0.0005	0.0017	F	=151.6836
0.0005	0.0017	dw	= 2.4252
-0.0018	0.0025		
0.0273	0.0105		
0.0840	0.0314		
-0.1094	0.1247		
0.0429	0.0251		

$S_{389}x10^{-3}$(000) Chemical Products n.e.i.

0.0065	0.0323		
-0.0138	0.0117	Constant	= 765.8021
0.0097	0.0206		
0.0054	0.0050	R^2	= .9897
-0.0013	0.0049	F	= 96.7308
-0.0035	0.0071	dw	= 1.8053
-0.0080	0.0297		
-0.0278	0.0891		
0.4772	0.3537		
0.0893	0.0713		

$S_{393}x10^{-3}$(000) Bituminous Paving and Roofing Material

-0.0080	0.0095		
-0.0007	0.0034		
-0.0072	0.0060		
-0.0034	0.0014	Constant	= 243.4646
0.0005	0.0014		
-0.0006	0.0021	R^2	= .9306
0.0092	0.0087	F	= 13.4169
0.0421	0.0262	dw	= 2.0393
-0.0452	0.1040		
0.0028	0.0209		

$S_{450}x10^{-3}$ (000) Range Making

0.0163	0.0111		
0.0038	0.0040		
0.0107	0.0071		
0.0005	0.0017	Constant	= -181.4949
0.0066	0.0017		
0.0019	0.0024	R^2	= .9647
-0.0104	0.0102	F	= 27.3984
-0.0382	0.0306	dw	= 1.7769
0.1915	0.1216		
-0.0184	0.0245		

$S_{455} x10^{-3}$(000) Radio and Television Assembly

Coefficients	Standard Errors			
0.0043	0.0278			
-0.0129	0.0100			
-0.0035	0.0177			
-0.0085	0.0043			
0.0038	0.0043	Constant	=	-575.4518
-0.0002	0.0061			
0.0574	0.0256	R^2	=	.9817
0.1846	0.0766	F	=	53.7596
-0.3145	0.3 42	dw	=	2.4346
0.1166	0.0613			

$S_{459} x10^{-3}$(000) Electrical Machinery, Appliances n.e.i. and Repairs

Coefficients	Standard Errors			
-0.1013	0.0575			
0.0097	0.0208	Constant	=	1139.3634
-0.0762	0.0367			
-0.0065	0.0090	R^2	=	.9940
0.0122	0.0088	F	=	165.7511
-0.0085	0.0127	dw	=	1.5564
0.2505	0.0529			
0.4037	0.1584			
-1.7844	0.6288			
0.2686	0.1268			

EFFECTS OF MODIFYING NAFTA: PREDICTIONS FROM THE REDUCED FORM

All goods imported to New Zealand are subject to import quotas and there is a variety of export subsidies for manufactured goods. The classification of goods imported differs from, and is finer than the classification of industries in the New Zealand statistics. Even goods which are exported are subject to an import quota - a coincidence which may be explained by the export subsidy, by market sharing agreements between internationally related firms within Nafta (or outside it) or by non comparable statistical classifications of goods. Of the twenty five industries only two export a significant proportion of their output to Australia. Their 1972 figues are for 10% for Range Making together with Radio and Television Assembly and 13% for the Manufacture of Paper and Paper Products. From this it is assumed that the small amounts exported by the remaining 23 industries arise either from public or privately induced market distortions or from non comparable statistical classifications. One is then permitted to assert that, were it not for the various protective or distorting devices, New Zealand would supplement the local output of the twenty three industries by imports. For estimating purposes it is assumed that none of the twenty five industries would supply the <u>entire</u> New Zealand demand for the goods they produce if there were a free trade situation.

Many variations to the New Zealand-Australia Free Trade Agreement may be conceived. One of the general interest to free traders and to protectionists alike is to consider the effects of a cet. par. instantaneous elimination the New Zealand tariff on the Australian goods which the twenty five industries also produce. It is assumed in doing this that the reason the products of only two of the twenty-five industries are imported from Australia is because of prohibitive protection of New Zealand industry, import quotas being beyond the scope of the NAFTA protocol. It is supposed that reducing the existing tariff on a good produced in Australia lowers the New Zealand price of the good by the amount of the tariff reduction. An estimate of dy, the change in income generated by twenty five manufacturing industries as result of expanding the New Zealand-Australia Free Trade Agreement in this way, is then available. One calculates the effects of the price changes on the principal components and then applies the estimated coefficients from the reduced form to the changed principal components of prices to obtain an estimated change in the income generated in the twenty five industries using equation (13).

The figure obtained in this way for the estimated effect of eliminating the tariff against the imports from Australia of the goods produced by the twenty five industries is an income change of $3.6m [3]

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[3] No confidence interval is given because of the non linearities involved, as explained earlier. The prediction is a point estimate of the effects of a change in tariffs when the non price exogenous variables are at their mean values. The effects of the tariff change on prices have been calculated from the means of the price principal components.

The estimated change in income generated in the manufacturing industries, after the tariff reduction of $3.6m compares with a mean income for the sample period of $284m. Wage incomes for the twenty five industries are estimated to change by $4.9m (mean $183.7m), salaries to change by $3.9m (mean $20.6m) and profits to change by - $5.2m (mean $77.8m).

Detailed predictions of the changes in average wage incomes, in average salary incomes, in manufacturing surpluses - the proxy for profit from which it varies by the depreciation charges and the changes in average incomes generated are presented in Table I for each industry. The mean for each variable is also given there for the sample period.

Table I

General Equilibrium effects. Estimated effects on Average Annual Wage Incomes, Salary Incomes, Profits and Total Incomes Generated in Twenty Five Industries of Eliminating the Tariffs on Imports from Australia

S.T.I.C. Classification	Name of Industry	Wage Income deflated $(000) Average	Change	Salary Income deflated $(000) Average	Change	Profits deflated $(000) Average	Change	Total Inc. Generated deflated $(000) Average	Change
200	Meat Freezing and preserving	38046	- 590	5220	1622	11724	-16978	54990	-15944
205	Ham and Bacon	1816	- 396	466	- 20	1290	148	3572	- 268
207	Sausage Casings	308	122	23	14	186	36	517	172
232	Brewing	2508	438	666	- 60	8200	2150	11374	2528
236	Areated Waters	844	134	274	24	1964	- 118	3082	38
251	Woollen Milling	5235	432	588	- 14	940	1622	6763	2040
260	Hosiery	5728	3246	1080	196	4120	-1802	10928	1638
262	Phormium Flax	173	- 42	20	- 40	110	- 156	303	- 202
263	Linen Flax	70	- 28	12	- 4	- 7	46	75	14
27+	Clothing Summary	19488	3142	598	566	9660	-2526	29746	1182
300	Sawmills	9414	496	2222	680	3880	2338	15516	3514
330	Pulp, paper	5664	202	1424	312	6644	4730	13732	5244
360	Motor Tyres & Tubes	34321	2974	516	- 6	2310	624	37147	3592
363	Rubber goods Other	2702	2600	580	24	1192	470	4474	3098
366	Vulcanising	917	78	348	16	1239	1472	2504	1570
370	Chemical Fertilizers	2181	- 1750	522	68	2876	432	5579	- 1248
372	Vegetable & Animal Oils	702	890	196	0	734	348	1632	1238
377	Soap	655	74	354	- 32	1096	- 416	2105	- 376
380	Paint & Varnish	10976	3578	702	22	2058	232	13736	3834
383	Pharmaceuticals	11250	-10794	752	46	2292	292	14294	-10454
389	Chemical Products	18929	510	1094	- 2	2872	54	22895	560
390	Petroleum & Coal Products	367	178	-	-	1982	1774	2349	1952
393	Bitumous Paving	349	96	160	32	554	272	1063	402
450	Range making	1603	-126	298	-94	740	180	2641	-40
455	Radio & T.V. Assembly	4249	-872	680	-8	2966	2394	7895	1514
459	Electrical Machinery	5269	352	1806	538	6240	-2832	13315	-1942
		183,764	4,950	20,601	3,922	77,848	-5210	284,213	3,662

Errors in cross adds and totals due to rounding

Dissaggregating the changes to the industry by industry level shows that income generated rises in 17 of the 25 industries so that the factors who gain in those industries should be able to compensate the losers in those industries. Incomes decline in 8 of the industries so compensation within each of those industries is not possible. A decline in the profit income or in the labour income in an industry does not imply that the industry will vanish or even that its physical output will decline. There is a small number of puzzles in the Table I. Concerning the Meat Freezing and Preserving Industry (Industry 200), perhaps the assumption that New Zealand would import from Australia the commodities produced by this industry is unjustified. If such is the case the tariff reduction in fact

should be interpreted as a decline in the export price which would account for the income losses. The remaining puzzles require detailed knowledge of particular industries, if they are to be resolved.

CONCLUSION

Overall it is estimated that eliminating the tariff on the goods produced in Australia increases the average income generated in the twenty five New Zealand industries by a miniscule \$3.6m or about 1%. This is a grain of evidence that there is water in the New Zealand tariff; as a whole the group of industries would not, it seems, be seriously affected if the New Zealand-Australia Free Trade Agreement were modified by New Zealand moving to tariffs of zero on goods produced by the group. Accepting the estimates at their face value suggests that wage and salary incomes would be increased over all by about 2% and 20% respectively. Profits i.e. manufacturing surplus are estimated to decline by about eight percent which is probably comparable to their annual fluctuation - scarcely cause for concern. Neither the employment nor the industrial infrastructure apologists for the New Zealand tariff find their positions reinforced by these estimates. From these figures it would appear that protectionists should not consider that the elimination of tariffs on imports from Australia would have disastrous effects on these New Zealand industries as a whole. One point must be emphasised; $3.6m is a twenty five industry general equilibrium estimate of what would happen if all the tariffs on goods produced in Australia and similar to the goods produced by the twenty five industries were simultaneously removed. A piecemeal reduction in tariffs has effects which could be estimated using the techniques presented above but none of the estimates in Table I can be used as estimates for the piecemeal case.

Finally, if these estimates are to be believed, New Zealand has something to bargin with in any renegotiation of the New Zealand-Australia Free Trade Agreement. It would not suffer a manufacturing income loss with respect to the elimination of its tariffs against Australia so it is in a position to offer an overall elimination of the tariffs on Australian goods. In return for offering such an across the board concession to Australia, instead of the piece-meal approach on individual goods, it may expect reciprocation. To the best of the writer's knowledge the across the board approach to that Free Trade Agreement has never been seriously examined elsewhere.

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APPENDIX I

The rates of tariffs which were then assumed to be reduced to zero are given in this appendix. A corresponding reduction in the New Zealand domestic price then occurs, from the small country assumption. The estimated price changes from their means were then incorporated into the three principal components of prices and the effects of such changes on the means of hours worked, wage rates, salaries and profits predicted as explained in Chapter IV.

THE TYPES OF PROTECTION ON THE PRODUCTS OF THE N.Z. INDUSTRIES STUDIED

Industry	N.Z. Tariff Item No.	N.Z. Tariff on Imports from Australia	Quota or No Quota
200	02.01	Beef 10%, Mutton Free.	No Quota
205	02.01	Free	"
207	05.04	Free	"
232	22.03	22% est.	Quota
236	22.01	17½%	"
251	53.11.048/051	32½%	"
260	60.03	10% est.	"
262	54.01	Free	No Quota
263	54.01	Free	"
274	61.01	32½%	Quota
300	44.04	Free	"
330	47 & 48	27½%	No Quota
363	40.08.003	Free	"
366		20%	Quota
370	31.01	Free	No Quota
372	15.12	22½%	Quota
377	34.01	27½%	"
380	32.	Free	"
383	33	"	"
389		"	Quota
390	27	"	No Quota
393		"	No Quota
450	85.11.009	32½%	Quota
455	85.15	32½%	"
459	85.06	25%	"

Sources (a) The Customs Tariff of New Zealand, 1974. New Zealand Customs Dept.
(b) The New Zealand Department of Trade and Industry, and the N.Z. Customs Dept.

APPENDIX II

Data

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PRINCIPLE COMPONENTS;P1
17353.280020893.480023027.830021741.470021427.650020185.5700
20378.590020515.560020373.170020564.300020268.930020280.3200
21577.910020460.170021015.610020462.410019130.710018534.6000
18433.250017158.970016850.7900

P2
-5967.4000-6723.3100-2559.5800-1871.1700-1186.9400-2451.6300
-2070.8700 -337.8700  -55.2400   29.2100  -36.9900  976.9500
 2716.8400 2856.5500 2937.3600 3437.4900 2940.9300 3393.4900
  107.6400 1576.2200 2210.8800

P3
 7867.5800  679.6400-2513.5800-1577.8500-1898.0200 -671.5300
-1475.2800-1837.9300-1839.5900-1485.2200-1265.3300 -679.0200
 1043.1300 1475.1100 1038.0600 1525.7500 1629.5100 1683.7800
 -622.9600 -243.3100 1177.4200

T1
14242.880016010.910011959.730014547.940015716.840015854.7700
 7123.6500 6669.4100 7464.9200 4996.1400 6165.4300 4739.5600
 7396.9200 5759.5900 5725.0100 7569.440010281.670010465.6700
16840.490022272.650025913.5700

T2
 1782.1200 -527.7800-1566.1700 -228.3600  -12.4600 -786.9800
 -876.3900-1135.1600-1690.2600 -709.8600 6369.8400 -786.0200
-3040.9900 -554.0500-1745.7200 -902.6900-3618.0900-2377.9800
-3879.9200 3544.7100 3500.6900

T3
-3310.4800 -475.5400-1640.3100 -680.7700 -991.8100-1097.7400
 -815.2200 -191.2500 -242.0700 -507.4000 1052.7600 -510.7800
 2254.9300 -140.3900 -285.5600   96.8500 3575.6800-4086.0300
 2461.8700 2349.1900 1972.4200

K1
  833.7400  980.6400 1192.5100 1482.1200 1345.7800 2308.7500
 2834.1500 3395.7000 4068.3100 4816.4800 5702.7200 6701.6400
 7813.030010097.590011321.320012871.890014433.360016071.3700
17861.050016473.120017334.7800

K2
 -111.7400 -120.1700 -140.4000 -159.9100 -176.7200  -73.0900
  -99.5400  -80.1400  -22.5300   34.0300   55.3600   63.9400
  935.1200  474.8100  282.5900   14.5800 -322.4300 -680.4400
-1097.8300 -213.0200 -361.2400

TIME
  100.0000  200.0000  300.0000  400.0000  500.0000  600.0000
  700.0000  800.0000  900.0000 1000.0000 1100.0000 1200.0000
 1300.0000 1400.0000 1500.0000 1600.0000 1700.0000 1800.0000
 1900.0000 2000.0000 2100.0000

INCOME/HEAD.POUNDS/HOURXE4
 6180.0000 6078.0000 6609.0000 6847.0000 6933.0000 6865.0000
 6925.0000 6665.0000 6989.0000 7254.0000 7204.0000 7439.0000
 7759.0000 7728.0000 8052.0000 7832.0000 7670.0000 7668.0000
 7816.0000 8197.0000 8559.0000

WAGES, POUNDS PER HOURXE3;W200
  519.1000  435.6000  414.4000  419.9000  438.4000  455.1000
  454.1000  473.9000  476.0000  499.6000  512.1000  521.6000
  546.9000  538.5000  532.8000  549.0000  566.8000  578.0000
  592.0000  530.7000  679.0000

W205XE3
  427.4000  418.4000  434.8000  432.7000  441.4000  441.0000
  438.3000  418.1000  432.9000  435.1000  437.9000  422.7000
  419.1000  446.3000  441.7000  491.9000  424.0000  406.0000
  431.4000  421.3000  486.0000
```

W207

382.7000	410.5000	429.8000	446.7000	454.7000	481.6000
467.4000	444.7000	472.7000	497.4000	499.0000	495.2000
495.9000	438.5000	479.9000	464.4000	518.2000	511.0000
498.2000	669.8000	569.1000			

W232

385.8000	390.5000	415.0000	430.8000	460.7000	470.6000
457.8000	459.3000	478.8000	469.2000	483.2000	473.2000
471.6000	488.7000	505.2000	511.0000	500.7000	514.8000
532.2000	609.7000	772.6000			

W236

355.2000	373.3000	402.5000	394.8000	390.6000	384.3000
381.1000	375.0000	380.2000	395.3000	398.8000	399.3000
421.5000	407.8000	394.7000	402.6000	394.7000	391.3000
396.5000	405.2000	426.3000			

W251

370.5000	346.9000	368.4000	371.6000	365.4000	350.8000
350.3000	343.6000	363.5000	354.7000	366.0000	370.9000
358.2000	364.3000	441.3000	369.0000	369.1000	392.1000
397.4000	418.5000	463.5000			

W260

312.4000	294.3000	316.4000	323.7000	340.7000	329.9000
325.7000	327.4000	335.1000	352.9000	356.7000	354.1000
360.0000	361.6000	352.5000	363.5000	359.5000	348.9000
408.4000	409.5000	0.0000			

W262

324.1000	382.8000	393.0000	371.9000	387.7000	396.0000
406.3000	385.8000	357.1000	392.3000	393.9000	330.2000
374.7000	393.1000	380.4000	374.5000	385.4000	380.8000
385.1000	416.3000	395.0000			

W263

302.5000	304.5000	286.4000	306.8000	310.5000	381.3000
374.4000	313.5000	351.7000	389.0000	361.6000	373.2000
381.7000	347.0000	346.6000	358.7000	375.1000	368.3000
376.1000	332.8000	382.4000			

W27PLUS

238.5000	231.4000	229.9000	239.2000	252.4000	249.4000
251.9000	260.0000	262.4000	274.6000	286.6000	291.7000
299.6000	295.0000	289.4000	298.7000	306.8000	298.2000
300.9000	318.0000	318.2000			

W300

395.4000	403.8000	412.7000	593.9000	430.9000	444.3000
449.8000	438.7000	460.2000	444.2000	447.1000	461.0000
449.8000	438.7000	460.2000	444.2200	447.1000	461.0000
465.0000	477.6000	492.2000			

W330

435.1000	448.6000	429.2000	545.8000	564.4000	616.7000
577.9000	562.0000	587.6000	613.6000	624.2000	622.5000
546.2000	679.4000	588.7000	670.5000	653.6000	634.3000
657.6000	845.4000	769.8000			

W360

500.0000	478.8000	473.5000	542.2000	547.1000	569.4000
651.4000	592.0000	606.7000	583.4000	632.2000	654.7000
655.6000	648.3000	720.9000	659.0000	721.0000	844.0000
869.0000	892.0000	872.0000			

W363

401.0000	391.0000	382.0000	411.0000	431.0000	426.0000
434.0000	445.0000	443.0000	440.0000	455.0000	466.0000
453.0000	474.0000	457.0000	465.0000	471.0000	452.0000
585.0000	691.0000	0.0000			

W366

450.0000	399.0000	418.0000	428.0000	431.0000	449.0000
426.0000	445.0000	436.0000	447.0000	538.0000	439.0000
463.0000	443.0000	446.0000	440.0000	365.0000	406.0000
434.0000	529.0000	517.0000			

W370

431.0000	408.0000	412.0000	443.0000	457.0000	442.0000
447.0000	433.0000	438.0000	456.0000	461.0000	464.0000
475.0000	521.0000	541.0000	374.0000	519.0000	536.0000
639.0000	56.0000	59.0000			

W372

360.1000	420.4000	433.6000	463.0000	449.0000	459.0000
433.0000	427.0000	466.0000	454.0000	459.0000	460.0000
477.0000	455.0000	479.0000	492.0000	485.0000	509.0000
496.0000	577.0000	553.0000			

W377

276.7000	360.6000	341.2000	377.5000	392.7000	378.8000
403.0000	412.7000	376.1000	409.8000	400.0000	388.7000
430.4000	413.1000	398.0000	423.2000	733.9000	415.0000
412.2000	426.0000	420.0000			

W380

253.1000	354.7000	377.4000	408.3000	431.9000	407.8000
399.3000	416.2000	451.8000	455.6000	454.4000	446.3000
449.5000	445.8000	450.8000	463.1000	465.2000	458.7000
463.6000	496.1000	520.5000			

W383

277.0000	307.0000	286.0000	290.0000	302.0000	318.0000
318.0000	312.0000	303.0000	319.0000	319.0000	305.0000
321.0000	320.0000	269.0000	326.0000	336.0000	360.0000
330.0000	341.0000	356.0000			

W389

338.5000	338.7000	352.4000	378.8000	383.5000	393.9000
383.7000	374.0000	379.6000	395.0000	380.0000	378.9000
395.3000	392.6000	406.2000	424.8000	455.2000	414.2000
414.7000	433.5000	458.6000			

W390

466.8000	424.8000	449.2000	464.5000	490.8000	511.4000
546.4000	461.9000	470.2000	465.4000	458.9000	425.6000
488.8900	556.2000	555.1000	588.3000	554.6000	522.7000
562.0000	592.6000	57.8000			

W393

449.8000	397.1000	426.6000	443.5000	430.6000	444.4000
453.6000	424.4000	417.4000	427.9000	437.8000	427.8000
464.4000	436.6000	487.6000	501.7000	438.1000	476.6000
463.0000	581.2000	615.7000			

W450

406.0000	386.7000	393.6000	403.3000	415.1000	404.4000
401.4300	397.9000	411.5000	411.7000	423.1000	441.8000
441.9000	460.2000	441.5000	451.3000	428.2000	416.8000
415.4000	445.5000	485.0000			

W455

356.7000	336.9000	342.5000	360.1000	377.6000	363.3000
364.6000	364.6000	354.8000	348.2000	379.9000	344.6000
352.7000	381.2000	374.0000	381.3000	385.9000	381.6000
477.6000	319.4000	439.4000			

W459

347.0000	366.3000	370.5000	373.4000	394.5000	394.8000
396.4000	390.3000	395.1000	405.0000	407.7000	401.6000
419.7000	413.5000	416.5000	437.6000	416.4000	415.5000
420.0000	456.0000	485.7000			

ANNUAL HOURS WORKED TIME SERIES V200XE-5

249.0600	253.9200	258.1700	272.3500	294.5200	289.5200
308.3300	331.6700	342.5800	348.0200	372.3600	385.5300

386.3300	398.5100	399.6600	418.5900	442.9100	476.4100
565.5500	519.5700	502.2300			

V205XL=4

129.1000	135.4000	131.0000	142.2000	161.9000	169.5000
175.4000	180.9000	190.2000	216.1000	236.0000	260.2000
274.6000	280.4000	289.1000	239.7000	218.3000	235.2000
230.5000	234.3000	247.2000			

V207XL=3

331.5340	319.6700	312.9160	253.4590	279.5030	281.3440
292.7050	312.5390	338.1910	375.2330	404.8910	392.4640
363.0170	393.4400	397.2400	421.7200	419.8300	442.4600
469.3900	497.2000	488.6300			

V232XL=4

253.7909	259.6214	257.5677	257.6558	257.4225	263.4111
265.0313	239.0521	219.3143	230.6345	233.8699	255.5985
251.5792	253.1300	265.3840	275.9600	283.2760	259.5600
257.9480	257.9920	271.2440			

V236XL=3

502.7340	842.0410	832.7400	899.8790	919.5230	1063.5320
1115.1290	1128.3740	1058.5720	1064.5510	1109.7920	1082.2170
1003.2950	945.4300	1090.0000	1114.0400	1092.0000	1109.2000
1254.6000	1454.6400	1468.5200			

V251XL=4

442.6907	484.5266	515.7630	510.1762	491.3199	490.6210
509.0189	605.2456	542.8082	714.4234	746.3436	733.7936
772.4249	641.2320	394.3040	340.7680	778.3640	709.9720
860.5480	387.5030	365.8800			

V260XL=4

639.5807	617.0930	663.7650	726.5665	692.1930	686.1710
752.9940	816.7262	831.3386	825.3851	844.0082	761.5009
798.6915	809.1480	355.5760	918.8320	897.2880	907.0200
1044.5280	1022.2280	1021.2400			

V262XL=3

295.6570	343.8110	332.2400	330.2570	218.6000	261.8670
208.2650	199.8350	223.4240	201.8970	220.3150	272.9200
238.2280	223.4090	224.4800	210.7600	199.9600	189.2000
154.9200	136.2400	99.0400			

V263XL=3

271.9100	235.3600	207.7130	154.4000	145.6530	72.0940
72.0940	58.8000	86.2730	81.9850	76.8240	70.7610
69.6300	69.6000	70.7200	71.0400	55.0000	62.8400
58.9200	53.0000	53.0000			

V27 XL=5

343.3805	313.4438	325.0732	342.6825	348.7829	327.5687
341.3195	353.9975	335.5234	347.2381	350.2295	342.3256
355.1332	306.3340	375.4364	380.0792	359.4306	344.3744
359.1176	421.9544	382.7434			

V300XL=4

998.5840	1050.6363	1012.0530	765.0035	1104.1659	1003.8179
1033.5781	1053.6224	1109.6500	1176.7050	1100.6040	1054.9460
1025.1840	1069.3720	1080.7340	1015.2240	990.8240	1041.4520
1073.6360	1042.5640	998.9720			

V330XL=4

148.1600	138.2160	180.2380	194.7040	342.1960	370.6160
395.5440	383.1120	407.3440	476.9360	463.7440	536.3560
573.6160	572.4240	585.5400	622.4920	619.7560	629.8840
643.7580	677.4740	737.2540			

V360XL=5

140.0000	98.4552	107.0486	144.7645	170.5956	165.9216
158.6000	139.0800	153.9000	171.3000	161.8000	164.8000
171.3000	179.9000	180.2000	161.3000	180.9000	164.0000
163.5000	196.6000	196.8000			

V363XL=4

300.0000	197.0000	226.0000	265.0000	259.6000	249.8000
256.2000	281.3000	276.7000	303.2000	314.5000	306.0000
309.7000	337.6000	357.8000	369.8000	354.2000	350.8000
402.6000	388.8000	389.4000			

V366XL=4

65.0000	70.6000	77.0000	82.7000	94.8000	91.8000
94.3000	92.0000	96.6000	100.9000	101.0000	94.9000
100.1000	103.3000	111.3000	112.1000	132.3000	133.0000
158.6000	133.6000	115.8000			

V370XL=4

225.7000	230.5000	223.9000	257.4000	267.8000	256.8000
254.0000	241.4000	259.5000	277.0000	271.2000	256.6000
253.8000	267.7000	279.0000	373.3000	215.0000	215.9000
214.0000	244.9000	240.6000			

V372XL=3

905.0000	669.0000	586.0000	662.0000	632.0000	674.0000
733.0000	752.0000	802.0000	815.0000	806.0000	794.0000
600.0000	759.0000	760.0000	780.0000	790.0000	733.0000
793.0000	712.0000	716.0000			

V377XL=3

1277.0000	870.0000	887.0000	822.0000	814.0000	737.0000
727.0000	77[illegible].0000	746.0000	702.0000	731.0000	769.0000
742.0000	799.0000	807.0000	812.0000	719.0000	730.0000
790.0000	78[illegible].0000	801.0000			

V380XL=5

151.5000	111.6000	119.2000	132.2000	127.2000	138.4000
142.5000	140.2000	135.2000	140.1000	134.7000	115.4000
121.4000	129.9000	121.8000	115.3000	113.4000	114.3000
115.0000	119.7000	127.7000			

V383XL=5

115.6000	110.3000	115.7000	119.5000	116.8000	117.0000
116.0000	121.8000	142.4000	155.0000	152.5000	151.0000
158.6000	132.0000	204.9000	211.8000	206.3000	211.5000
209.0000	235.9000	242.0000			

V389XL=5

171.2000	179.2000	185.3000	190.6000	200.8000	204.6000
203.9000	211.6000	223.8000	231.0000	258.0000	237.2000
254.9000	205.6000	270.5000	260.7000	248.7000	265.4000
302.0000	316.7000	323.0000			

V390XL=3

188.0000	211.0000	220.0000	213.0000	223.0000	225.0000
240.0000	294.0000	296.0000	326.0000	356.0000	391.0000
350.0000	548.0000	559.0000	577.0000	590.0000	559.0000
564.0000	547.0000	542.0000			

V393XL=3

190.0000	210.0000	208.0000	233.0000	294.0000	343.0000
350.0000	357.0000	367.0000	396.0000	406.0000	437.0000
430.0000	470.0000	509.0000	544.0000	465.0000	413.0000
442.0000	414.0000	451.0000			

V450XL=4

150.2660	186.8802	197.2096	180.0230	204.6940	170.8921
172.6589	195.4269	189.9590	199.9849	211.7274	191.1809
153.0184	172.1969	186.2520	196.8480	179.3360	172.8520
175.2500	243.5000	199.1200			

```
V455XE=4
   177.6569   171.0047   185.8802   193.7920   180.0246   157.2816
   181.2861  1982.0970   226.5831   332.3408   349.3769   412.1418
   511.2871   545.3080   484.2480  4385.2000   306.6440   304.2880
   275.0240   337.1600   332.4400

V459XE=4
   362.9665   344.4528   382.0723   401.8214   391.5279   362.0604
   379.3474   400.7186   423.4576   470.8973   508.0288   574.6746
   631.3022   812.1560   934.2200  1032.8480   955.2040   942.5000
  1034.2080  1141.5120  1143.4520

ANNUAL SALARIES IN 000 POUNDS;S200XE=4
   152.2000   158.1000   171.4000   173.2000   195.2000   209.4000
   212.4000   213.3000   224.3000   239.2000   248.8000   260.5000
   282.4000   291.1000   306.7000   343.8000   334.8000   340.7000
   378.0000   468.8000   363.7000

S205XE=4
   154.0000   160.0000   167.0000   150.0000   152.0000   164.0000
   169.0000   186.0000   212.0000   242.0000   258.0000   286.0000
   267.0000   311.0000   301.0000   261.0000   278.0000   286.0000
   262.0000   276.0000   287.0000

S207XE=3
    17.0000    20.0000    19.0000    17.0000    10.0000    16.0000
    15.0000    13.0000    13.0000    10.0000    11.0000     7.0000
     6.0000     8.0000     8.0000    23.0000    22.0000    21.0000
    21.0000    35.0000    37.0000

S232XE=3
   242.0000   256.0000   230.0000   278.0000   269.0000   247.0000
   251.0000   247.0000   230.0000   236.0000   276.0000   326.0000
   367.0000   391.0000   421.0000   441.0000   442.0000   445.0000
   431.0000   484.0000   491.0000

S236XE=3
   125.0000   128.0000   124.0000   133.0000   136.0000   149.0000
   174.0000   166.0000   166.0000   177.0000   191.0000   194.0000
   193.0000   192.0000   216.0000   210.0000   206.0000   224.0000
   249.0000   272.0000   317.0000

S251XE=3
   166.0000   140.0000   161.0000   171.0000   178.0000   135.0000
   191.0000   186.0000   204.0000   220.0000   251.0000   261.0000
   287.0000   329.0000   392.0000   425.0000   420.0000   422.0000
   481.0000   552.0000   564.0000

S260XE=3
   335.0000   324.0000   341.0000   345.0000   374.0000   380.0000
   416.0000   457.0000   451.0000   501.0000   440.0000   556.0000
   579.0000   569.0000   570.0000   741.0000   688.0000   691.0000
   712.0000   803.0000   899.0000

S262XE=2
   180.0000   200.0000   200.0000   230.0000   300.0000   250.0000
   220.0000   220.0000   220.0000   220.0000   220.0000   230.0000
   230.0000   240.0000   200.0000   160.0000   170.0000   200.0000
   190.0000   150.0000    70.0000

S263XE=2
   110.0000   110.0000   120.0000   100.0000    80.0000   100.0000
    70.0000    40.0000    40.0000    30.0000    40.0000   100.0000
    50.0000    40.0000    50.0000    40.0000    50.0000    40.0000
    40.0000    50.0000    60.0000

S27PLUSXE=4
   252.3000   243.5000   244.0000   252.3000   266.2000   259.0000
   279.4000   281.2000   284.8000   305.3000   303.7000   308.4000
   323.4000   329.3000   337.8000   340.4000   318.9000   321.0000
   345.5000   359.7000   327.1000
```

S300XL=4

93.8000	92.2000	91.7000	98.1000	114.4000	102.9000
105.0000	108.7000	103.0000	103.2000	116.1000	107.4000
110.7000	115.2000	120.0000	121.0000	111.2000	111.5000
113.3000	111.7000	116.2000			

S330XL=3

102.0000	102.0000	126.0000	132.0000	347.0000	354.0000
373.0000	486.0000	547.0000	558.0000	563.0000	809.0000
875.0000	945.0000	1018.0000	1061.0000	1042.0000	1139.0000
1288.0000	1477.0000	1514.0000			

S360XL=3

162.0000	132.0000	153.0000	179.0000	188.0000	219.0000
213.0000	205.0000	209.0000	220.0000	211.0000	274.0000
294.0000	280.0000	292.0000	312.0000	311.0000	348.0000
384.0000	335.0000	401.0000			

S363XL=3

162.0000	122.0000	145.0000	159.0000	180.0000	187.0000
183.0000	190.0000	192.0000	212.0000	261.0000	323.0000
352.0000	365.0000	380.0000	430.0000	421.0000	429.0000
447.0000	461.0000	503.0000			

S366XL=3

91.0000	97.0000	103.0000	126.0000	157.0000	156.0000
164.0000	166.0000	183.0000	194.0000	212.0000	220.0000
202.0000	189.0000	176.0000	177.0000	172.0000	226.0000
235.0000	196.0000	225.0000			

S370XL=3

154.0000	156.0000	153.0000	190.0000	209.0000	209.0000
195.0000	211.0000	203.0000	243.0000	204.0000	275.0000
302.0000	325.0000	340.0000	341.0000	333.0000	319.0000
355.0000	387.0000	335.0000			

S372XL=1

77.0000	75.0000	74.0000	69.0000	78.0000	85.0000
100.0000	93.0000	101.0000	114.0000	115.0000	105.0000
95.0000	96.0000	101.0000	106.0000	103.0000	101.0000
107.0000	137.0000	123.0000			

S377XL=3

127.0000	124.0000	117.0000	123.0000	191.0000	168.0000
164.0000	167.0000	152.0000	150.0000	160.0000	160.0000
168.0000	155.0000	162.0000	170.0000	233.0000	237.0000
241.0000	249.0000	304.0000			

S380XL=3

185.0000	158.0000	135.0000	167.0000	221.0000	222.0000
278.0000	316.0000	360.0000	374.0000	372.0000	393.0000
415.0000	451.0000	487.0000	477.0000	471.0000	462.0000
463.0000	454.0000	484.0000			

S383XL=3

151.0000	144.0000	146.0000	151.0000	164.0000	167.0000
168.0000	133.0000	207.0000	212.0000	222.0000	266.0000
326.0000	355.0000	375.0000	401.0000	375.0000	338.0000
415.0000	354.0000	517.0000			

S389XL=3

191.0000	188.0000	221.0000	261.0000	302.0000	305.0000
647.0000	654.0000	657.0000	713.0000	748.0000	836.0000
352.0000	373.0000	403.0000	484.0000	507.0000	585.0000
952.0000	958.0000	1134.0000			

S393XL=3

23.0000	32.0000	44.0000	40.0000	45.0000	60.0000
64.0000	67.0000	87.0000	91.0000	94.0000	105.0000
106.0000	113.0000	120.0000	116.0000	98.0000	107.0000
98.0000	121.0000	59.0000			

```
S450XL=3
   79.0000    76.0000    82.0000    67.0000   113.0000    88.0000
   99.0000   113.0000   142.0000   160.0000   201.0000   158.0000
  164.0000   182.0000   188.0000   199.0000   205.0000   197.0000
  169.0000   253.0000   236.0000

S455XL=3
  142.0000   144.0000   149.0000   155.0000   161.0000   155.0000
  175.0000   178.0000   205.0000   269.0000   297.0000   331.0000
  519.0000   576.0000   579.0000   574.0000   453.0000   464.0000
  517.0000   546.0000   524.0000

S459XL=3
  302.0000   328.0000   338.0000   359.0000   369.0000   364.0000
  388.0000   384.0000   420.0000   470.0000   573.0000   679.0000
  794.0000  1196.0000  1331.0000  1450.0000  1536.0000  1665.0000
 1801.0000  1991.0000  2134.0000

ANNUAL PROFITS IN POUNDS;M200XE=4
  709.3000   480.2000   359.2000   497.1000   508.8000   358.1000
  176.3000  =192.3000   655.9000   541.4000   829.6000   634.7000
  886.5000   129.2000   696.6000   219.3000   933.7000  1135.4000
  731.5000   445.2000  1282.0000

M205E=3
  354.0000   552.0000   542.0000   361.0000   514.0000   470.0000
  522.0000   493.0000   462.0000   470.0000   480.0000   556.0000
  559.0000   677.0000  1000.0000   894.0000   722.0000   717.0000
 1244.0000  1900.0000   969.0000

M207E=3
  139.0000    58.0000    89.0000    49.0000    37.0000    63.0000
   75.0000    69.0000    40.0000    39.0000    76.0000   118.0000
  132.0000   136.0000   158.0000   122.0000    53.0000   116.0000
  117.0000   153.0000   106.0000

M232E=4
  198.3000   213.6000   333.6000   218.4000   321.6000   238.8000
  290.4000   338.1000   319.0000   400.2000   514.2000   573.7000
  654.2000   653.7000   804.1000   803.1000   869.5000   773.8000
  445.8000   498.5000   410.9000

M236E=3
  519.0000   656.0000   484.0000   610.0000   589.0000   727.0000
  909.0000   805.0000   695.0000   897.0000   769.0000   849.0000
 1073.0000  1000.0000  1303.0000  1202.0000  1116.0000  1112.0000
 1576.0000  1853.0000  1975.0000

M251E=4
   75.2000    69.3000    60.0000    41.6000    58.6000     3.4000
   73.7000    91.4000   148.6000   134.1000   134.8000    43.0000
   35.7000    47.9000   196.2000   159.5000   118.0000    46.5000
  111.7000   137.7000    46.7000

M260E=4
  116.3000   124.3000   136.7000   138.1000    88.2000   102.9000
  150.9000   187.8000   248.7000   206.1000   255.7000   236.9000
  206.9000   245.4000   334.6000   302.6000   320.2000   355.7000
  169.3000   156.7000   150.2000

M262E=3
   94.0000   129.0000    87.0000   108.0000    87.0000    49.0000
   30.0000    23.0000    54.0000    52.0000    81.0000    26.0000
   80.0000    51.0000    24.0000    53.0000    64.0000    34.0000
   20.0000    12.0000     0.0000

M263E=3
   34.0000   =30.0000   =26.0000    55.0000   =17.0000   =40.0000
  =52.0000   =11.0000     1.0000     3.0000     0.0000     6.0000
    0.0000    =4.0000     4.0000    11.0000    =3.0000    =4.0000
    0.0000    =4.0000    =1.0000
```

```
M27E-4
   491.6000   302.9000   325.3000   475.8000   430.5000   377.7000
   306.3000   417.9000   355.1000   446.2000   481.8000   502.7000
   631.9000   553.4000   707.2000   645.6000   630.4000   608.5000
   434.9000   464.6000   447.2000

M300E-4
   169.2000   138.8000   153.7000   167.3000   119.5000    90.5000
   124.2000   132.1000   135.0000   140.0000   143.2000   138.6000
   212.2000   310.8000   334.1000   236.1000   230.6000   259.6000
   222.7000   290.7000   327.3000

M330E-3
  1023.0000   940.0000   854.0000   878.0000-1057.0000   112.0000
  1955.0000  2144.0000  3329.0000  4064.0000  3648.0000  3347.0000
  4184.0000  5288.0000  5433.0000  5396.0000  5694.0000  6084.0000
  5487.0000  6105.0000  4160.0000

M360E-3
   976.0000   830.0000   738.0000   922.0000   949.0000   917.0000
   913.0000   988.0000   975.0000  1161.0000  1369.0000  1469.0000
  1521.0000  2640.0000  1386.0000  1523.0000  1040.0000  1313.0000
  1445.0000   902.0000  1027.0000

M363E-3
   500.0000   322.0000   438.0000   499.0000   349.0000   216.0000
   393.0000   525.0000   633.0000   482.0000   556.0000   795.0000
   797.0000  1000.0000  1003.0000   889.0000   541.0000   781.0000
   695.0000   637.0000   481.0000

M366E-3
   315.0000   306.0000   357.0000   374.0000   265.0000   291.0000
   341.0000   381.0000   467.0000   415.0000   403.0000   401.0000
   533.0000   577.0000   519.0000   451.0000   597.0000  1000.0000
  1701.0000  1502.0000  1544.0000

M370E-3
  1001.0000   842.0000  1013.0000  1153.0000   946.0000   872.0000
   301.0000   430.0000  1143.0000  1501.0000  1101.0000  1448.0000
  2273.0000  2176.0000  1799.0000  1489.0000  3572.0000  1440.0000
  1374.0000  1386.0000  1945.0000

M372E-3
   444.0000   408.0000   355.0000   326.0000   343.0000   356.0000
   330.0000   294.0000   306.0000   335.0000   176.0000   244.0000
   307.0000   410.0000   391.0000   380.0000   379.0000   393.0000
   625.0000   442.0000   465.0000

M377E-3
   247.0000   350.0000   413.0000   245.0000   204.0000   343.0000
   367.0000   457.0000   803.0000   941.0000   866.0000   961.0000
   442.0000   575.0000   450.0000   683.0000   833.0000   658.0000
   511.0000   686.0000  1412.0000

M380E-3
   537.0000   339.0000   595.0000   723.0000   579.0000   599.0000
   565.0000   744.0000   352.0000   742.0000   460.0000  1351.0000
  1148.0000  1475.0000   847.0000   561.0000  1058.0000  1359.0000
  2291.0000  3226.0000  2056.0000

M383E-3
   499.0000   447.0000   543.0000   552.0000   609.0000   630.0000
   711.0000   517.0000   792.0000   909.0000   896.0000   938.0000
  1441.0000  1468.0000  1516.0000  1959.0000  1879.0000  2017.0000
  1864.0000  2174.0000  1511.0000

M389E-3
   685.0000   583.0000   557.0000   786.0000   699.0000   696.0000
   568.0000   892.0000  1115.0000   910.0000  1013.0000  1234.0000
  1454.0000  1475.0000  1980.0000  3108.0000  1497.0000  2148.0000
  2417.0000  3020.0000  2937.0000
```

M390E-3

34.0000	46.0000	95.0000	76.0000	81.0000	87.0000
101.0000	120.0000	140.0000	205.0000	232.0000	301.0000
331.0000	859.0000	1875.0000	2015.0000	2292.0000	2656.0000
3244.0000	3417.0000	2597.0000			

M393E-3

140.0000	99.0000	125.0000	199.0000	167.0000	194.0000
161.0000	191.0000	207.0000	202.0000	266.0000	328.0000
371.0000	357.0000	353.0000	338.0000	334.0000	404.0000
525.0000	548.0000	313.0000			

M450E-3

281.0000	314.0000	495.0000	461.0000	209.0000	190.0000
331.0000	404.0000	225.0000	511.0000	573.0000	625.0000
349.0000	573.0000	626.0000	455.0000	313.0000	162.0000
167.0000	283.0000	209.0000			

M455E-3

405.0000	309.0000	578.0000	371.0000	368.0000	446.0000
519.0000	474.0000	427.0000	359.0000	1291.0000	2128.0000
5270.0000	5521.0000	2548.0000	1561.0000	185.0000	557.0000
2372.0000	2344.0000	2423.0000			

M459E-4

88.9000	112.6000	134.4000	170.9000	172.8000	157.8000
215.2000	241.7000	244.0000	317.1000	316.9000	344.4000
427.8000	602.6000	534.0000	619.7000	547.4000	478.0000
266.4000	296.0000	283.7000			

PRICES;P200 000 POUNDS/CWTXE4

852.0000	1008.0000	988.0000	1032.0000	967.0000	999.0000
1119.0000	860.0000	881.0000	828.0000	816.0000	811.0000
870.0000	882.0000	906.0000	819.0000	893.0000	936.0000
955.0000	887.0000	1101.0000			

P205 POUNDS/CWTXE2

1385.6000	1513.6000	1564.9000	1464.6000	1500.6000	1479.6000
1605.9000	1420.5000	1468.8000	1526.6000	1535.3000	1523.6000
1476.8000	1510.8000	1580.8000	1732.6000	1619.1000	1572.3000
1593.2000	1549.8000	1445.8000			

P207 POUNDSCWTXE 3

1892.0000	1173.0000	1002.0000	1125.0000	1155.0000	1227.0000
1219.0000	1105.0000	585.0000	582.0000	609.0000	380.0000
1985.0000	1051.0000	1053.0000	927.0000	531.0000	597.0000
567.0000	923.0000	816.0000			

P232 POUNDS/GALLXE4

4100.0000	4030.0000	4090.0000	3380.0000	3790.0000	3590.0000
3520.0000	4580.0000	4910.0000	4950.0000	4920.0000	4840.0000
4740.0000	4560.0000	4580.0000	5760.0000	4340.0000	4160.0000
4390.0000	4320.0000	4070.0000			

P236 POUNDS/GALX4

3290.0000	3300.0000	3060.0000	3111.0000	2880.0000	2920.0000
3090.0000	3050.0000	3360.0000	3020.0000	2860.0000	2770.0000
3030.0000	2690.0000	2620.0000	2540.0000	2410.0000	2460.0000
2590.0000	2310.0000	2700.0000			

P251 POUNDS/POUNDSXE4

1156.9000	9216.0000	9410.0000	8982.0000	8234.0000	7795.0000
6980.0000	7910.0000	8402.0000	8259.0000	7754.0000	8177.0000
9479.0000	8446.0000	9414.0000	8894.0000	7899.0000	7876.0000
6349.0000	6853.0000	6420.0000			

P260 POUNDS/DOZ E3

8192.0000	8120.0000	8133.0000	7497.0000	7175.0000	7078.0000
7066.0000	6534.0000	6262.0000	6485.0000	6504.0000	5679.0000
5746.0000	5752.0000	5683.0000	5341.0000	5277.0000	5210.0000
5734.0000	5792.0000	5401.0000			

```
P262 POUNDS/TONXE2
 8369.0000 9347.0000 9350.0000 9828.0000 9348.0000 8936.0000
 8029.0000 8066.0000 7947.0000 8331.0000 8721.0000 8389.0000
 9041.0000 7925.0000 8267.0000 7730.0000 7827.0000 7375.0000
 7658.0000 7082.0000 6829.0000

P263 POUNDS/TONXE1
 1947.3000 1744.0000 1783.0000 1767.0000 1597.0000 2121.0000
 1545.0000 1465.0000 1397.0000 1703.0000 1598.0000 1368.0000
 1498.0000 1301.0000 1251.0000 1338.0000 1296.0000 1233.0000
 1221.0000  946.0000 1070.0000

P27PLUS POUNDS/UNITXE3
 1225.0000 1300.0000 1180.0000 1298.0000 1345.0000 1808.0000
 1300.0000 1177.0000 1803.0000  967.0000 1912.0000  950.0000
  939.7000  914.5000  899.8000  863.9000  846.2000  857.6000
  958.7000  946.7000  879.5000

P300 POUNDS/000BDFTXE2
 2513.3000 2997.4000 3250.8000 3575.4000 3323.4000 3418.3000
 3480.0000 3492.6000 3461.8000 3433.6000 3520.8000 3520.3000
 3426.5000 3306.2000 3370.5000 3304.4000 3251.4000 3142.9000
 3407.7000 3455.5000 3581.9000

P330
    0.0000    0.0000 6368.0000 5939.0000 7185.0000 4756.0000
 5082.0000 7278.0000 6932.0000 6859.0000 6712.0000 6479.0000
 5548.0000 5405.0000 6596.0000 6518.0000 6147.0000 6268.0000
 5383.0000 5886.0000 5411.0000

P360 POUNDS/UNITXE3
 5900.0000 7901.0000 7915.0000 5948.0000 5207.0000 5326.0000
 6218.0000 5792.0000 5986.0000 5024.0000 5022.0000 4813.0000
 4557.0000 4088.0000 4037.0000 3635.0000 3859.0000 3081.0000
 5304.0000 2613.0000 2570.0000

P353A POUNDSXE4
 2905.0000 2070.0000 1500.0000 1450.0000 1600.0000 2260.0000
 1550.0000 2500.0000 1510.0000 1700.0000 1510.0000 1570.0000
 1500.0000 1570.0000 1250.0000 2460.0000 1810.0000 2400.0000
 2000.0000 1060.0000 1380.0000

P353B POUNDS/PAIRXE4
 6260.0000 1310.0000 1530.0000 1990.0000 1780.0000 1760.0000
 1760.0000 2080.0000 2190.0000 2380.0000 2230.0000 2880.0000
 5340.0000 5640.0000 5710.0000 5960.0000 5970.0000 6330.0000
 2730.0000 2370.0000 4510.0000

P356 POUNDS/UNITXE3
 7588.0000 7942.0000 7509.0000 6754.0000 7354.0000 6756.0000
 6553.0000 6157.0000 5994.0000 5954.0000 5699.0000 5404.0000
 5520.0000 5223.0000 5093.0000 4443.0000 4181.0000 4200.0000
 4256.0000 3719.0000 3399.0000

P370 POUNDS/UNITXE3
 1587.0000 1492.0000 1332.0000 1211.0000 1211.0000 1219.0000
 1240.0000 1178.0000 1150.0000 1088.0000 1066.0000 1035.0000
 1017.0000  960.0000 1014.0000 1100.0000 1112.0000 1111.0000
 1033.0000 1005.0000  944.0000

P372 POUNDS/CWTXE3
 2947.0000 3246.0000 2196.0000 2190.0000 2613.0000 2525.0000
 2572.0000 2395.0000 2095.0000 1961.0000 1785.0000 1646.0000
 1724.0000 2597.0000 4518.0000 2237.0000 3629.0000 1758.0000
 2457.0000 2716.0000 2366.0000

P377 POUNDS/TONXE2
 1442.0000 1414.0000 1434.0000 1422.0000 1505.0000 1169.0000
 1523.0000 1451.0000 1469.0000 1447.0000 1454.0000 1421.0000
 1375.0000 1402.0000 1390.0000 1493.0000 1328.0000 1304.0000
 1247.0000 1254.0000 1245.0000
```

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P330 POUNDS/GALXE3
 2373.0000 2215.0000 2055.0000 2020.0000 1941.0000 1922.0000
 1565.0000 1549.0000 1330.0000 1779.0000 1734.0000 1686.0000
 1584.0000 1519.0000 1559.0000 1535.0000 1422.0000 1605.0000
 1442.0000 1412.0000 1323.0000

P363 POUNDS/CNTXE2
 4400.0000 3957.0000 5431.0000 4865.0000 4775.0000 4615.0000
 4670.0000 4499.0000 4989.0000 4776.0000 3799.0000 4717.0000
 4118.0000 3130.0000 4569.0000 4439.0000 3966.0000 4250.0000
 3745.0000 3087.0000 3615.0000

P389 POUNDS/CNTXE3
 1000.0000 1122.6000 1080.9000 1059.3000 1119.5000 1056.8000
 1202.0000 1156.7000 1182.5000 1153.5000 1135.8000 1229.3000
 1390.2000 1301.3000 1480.0000  907.1000 1040.8000  867.1000
  783.7000  981.8000  983.8000

P393 POUNDS/TONXE2
 2147.0000 2141.0000 1730.0000 1539.0000 1697.0000 1739.0000
 1962.0000 1856.0000 1773.0000 1695.0000 1679.0000 1616.0000
 1629.0000 1570.0000 1129.0000 1537.0000 1149.0000 1197.0000
 1220.0000 1284.0000  974.0000

P450 POUNDS/UNITXE2
 3757.0000 3905.0000 4439.0000 4450.0000 4910.0000 4620.0000
 5032.0000 4878.0000 4456.0000 4396.0000 4824.0000 4818.0000
 4754.0000 5414.0000 5126.0000 5016.0000 4933.0000 4678.0000
 4383.0000 4786.0000 4357.0000

P455 POUNDS/RECEIVERXE2
 2719.0000 2896.0000 2635.0000 2386.0000 2362.0000 2430.0000
 2643.0000 2510.0000 2220.0000 2495.0000 3104.0000 4637.0000
 5583.0000 5559.0000 4133.0000 4193.0000 3346.0000 3156.0000
 2380.0000 2240.0000 2085.0000

P459 POUNDS/UNIT
 3623.0000 3995.0000 3250.0000 3265.0000 3019.0000 3000.0000
 2925.0000 2812.0000 3240.0000 3245.0000 3376.0000 3496.0000
 2891.0000 2689.0000 2705.0000 2575.0000 2440.0000 2218.0000
 2743.0000 3374.0000 3764.0000

CAPITAL SERIES 000 OF POUNDS,K200XE-2
  120.9100  151.4300  197.7100  259.9300  343.2100  443.6100
  561.0000  687.0900  825.9500  992.1300 1193.4200 1409.6000
 1626.3100 1861.7300 2136.9800 2418.7900 2702.2000 3027.9400
 3422.5600 3871.6300 4274.8600

K205XE-1
   68.5000   88.7000  123.0000  167.6000  216.7000  270.7000
  328.3000  385.3000  444.3000  506.6000  567.7000  666.9000
  768.3000  886.6000 1016.2000 1153.1000 1294.1000 1435.3000
 1532.5000 1744.4000 1891.3000

K207XE1
   44.2000   51.3000   62.5000   75.1000   94.3000  116.3000
  141.2000  169.1000  216.4000  273.6000  312.9000  353.3000
  412.9000  459.4000  532.9000  596.3000  693.0000  771.2000
  847.2000  919.5000 1007.8000

K209XE-1
  101.1000  123.5000  165.3000  231.5000  343.3000  465.7000
  594.8000  722.7000  860.4000 1024.1000 1202.4000 1424.4000
 1641.5000 1859.2000 2065.8000 2279.2000 2497.3000 2738.0000
 2975.8000 3218.0000 3460.6000

K232XE-2
   28.1400   39.6200   59.3900   82.3700  110.9900  144.3700
  183.9500  235.7100  281.8600   34.2900  405.5300  478.8600
  556.8400  636.0200  716.3300  806.4200  881.5700  964.2000
 1048.5400 1144.4000 1246.9500
```

K230XE=1

88.1000	115.4000	148.2000	166.6000	238.5000	303.6000
373.5000	441.4000	506.4000	586.8000	665.1000	795.1000
906.1000	1062.2000	1259.3000	1450.6000	1673.7000	1897.2000
2140.2000	2427.7000	2757.3000			

K251XE=1

212.5000	263.0000	333.3000	410.8000	486.7000	586.4000
712.6000	841.4000	996.9000	1191.8000	1403.8000	1674.5000
2023.2000	2381.7000	2800.8000	3269.1000	3789.3000	4306.5000
4950.8000	5556.4000	6376.9000			

K260XE=1

302.1000	356.0000	433.4000	584.0000	747.3000	947.2000
1180.9000	1432.6000	1718.4000	2071.2000	2436.0000	2861.9000
3324.2000	3838.2000	4395.5000	4992.6000	5583.3000	6216.8000
6908.0000	7699.8000	8521.4000			

K27PLUSXE=1

697.4000	801.4000	936.8000	1105.8000	1315.4000	1518.7000
1795.8000	2121.5000	2463.8000	2836.7000	3258.3000	3704.8000
4179.4000	4677.8000	5217.7000	5786.2000	6366.8000	6957.8000
7577.5000	8293.5000	9049.2000			

K300XE=2

62.9200	73.5700	91.3600	115.8200	154.4100	201.1700
251.5300	307.9200	368.0500	433.5100	501.9900	584.6200
667.3900	751.4500	840.4900	937.5200	1042.7700	1149.0300
1262.7300	1379.0100	1495.3600			

K330XE=2

10.9000	12.3300	26.4500	43.3600	85.2100	142.6800
200.7500	255.9400	337.8300	425.7200	553.1000	820.0300
1077.0500	1321.4500	1507.2500	1900.7100	2192.7300	2467.0100
2834.7800	3170.7900	3524.9900			

K360XE=1

341.7000	384.0000	449.8000	537.1000	649.7000	749.2000
958.4000	1141.9000	1340.8000	1552.0000	1786.8000	2055.7000
2349.3000	2677.9000	3061.1000	3434.0000	3898.6000	4366.2000
4868.2000	5405.9000	5393.2000			

K370XE=2

2.9000	5.2400	10.0700	18.1300	31.5700	48.6400
67.0700	95.0700	126.1500	158.2900	192.2300	234.0700
276.5700	327.8300	399.2400	497.7000	600.7300	701.4600
802.3900	911.9800	1003.1300			

K372XE=1

59.1000	75.3000	101.3000	126.0000	159.3000	200.4000
255.2000	311.9000	370.7000	434.6000	503.9000	563.2000
637.4000	729.1000	803.2000	898.2000	1011.8000	1129.4000
1240.6000	1373.3000	1502.8000			

K377XE=1

64.5000	75.9000	107.3000	146.2000	191.0000	288.8000
321.9000	401.1000	480.7000	559.1000	640.7000	737.5000
864.4000	987.4000	1115.6000	1343.1000	1518.1000	1685.8000
1847.1000	1998.4000	2140.6000			

K380XE=1

73.3000	82.5000	97.6000	125.8000	209.9000	328.5000
435.3000	545.5000	649.6000	766.2000	887.6000	1015.3000
1277.7000	1416.9000	1610.7000	1312.4000	1980.1000	2168.5000
2346.4000	2596.7000	2865.7000			

K333XE=1

116.3000	122.1000	131.7000	151.5000	177.5000	210.0000
251.3000	319.3000	373.4000	444.4000	524.1000	613.4000
729.2000	838.7000	937.6000	1068.0000	1246.9000	1415.9000
1594.3000	1779.5000	1970.3000			

```
T360XE4
   650.0000   630.0000   540.0000   960.0000   960.0000 1050.0000
   580.0000   630.0000   630.0000   450.0000   550.0000  570.0000
   590.0000   620.0000   320.0000   520.0000   960.0000 1100.0000
  1370.0000  2400.0000  2300.0000

T363 POUNDS/HRXE4
   720.0000   670.0000   510.0000   390.0000   440.0000   330.0000
   170.0000   270.0000   290.0000   170.0000   170.0000   180.0000
   520.0000   210.0000   240.0000   490.0000   320.0000   350.0000
   930.0000  1140.0000  1060.0000

T366XE5
  5300.0000  5900.0000  4300.0000  5400.0000  5400.0000  6100.0000
  1700.0000  3200.0000  3000.0000  2000.0000  3200.0000  2000.0000
  2400.0000  2000.0000  2100.0000  2300.0000  2600.0000  5600.0000
  6200.0000  7800.0000  9500.0000

T370XE4
   800.0000   600.0000   580.0000   830.0000   790.0000   730.0000
   360.0000   340.0000   330.0000   260.0000   290.0000   280.0000
   310.0000   460.0000   530.0000   210.0000   620.0000   750.0000
  1450.0000  1490.0000  1640.0000

T372XE4
   490.0000   660.0000   510.0000   550.0000   620.0000   670.0000
   290.0000   210.0000   370.0000   230.0000   250.0000   240.0000
   280.0000   250.0000   300.0000   390.0000   390.0000   480.0000
   900.0000   870.0000  1090.0000

T377XE5
  3200.0000  5100.0000  3100.0000  4200.0000  3900.0000  4400.0000
  1400.0000  2500.0000  1300.0000  1300.0000  1200.0000  1300.0000
  4900.0000  1800.0000  1900.0000  2500.0000  9100.0000  2800.0000
  7200.0000  6300.0000  6600.0000

T380XE5
  5000.0000  5400.0000  4000.0000  5300.0000  6100.0000  5300.0000
  1500.0000  2500.0000  2300.0000  2100.0000  2200.0000  2100.0000
  2200.0000  2100.0000  2200.0000  2700.0000  3100.0000  3100.0000
  5100.0000  8400.0000  9300.0000

T383XE5
   480.0000   530.0000   330.0000   350.0000   350.0000   390.0000
   280.0000   540.0000   700.0000     0.0000     0.0000     0.0000
     0.0000   240.0000     0.0000   560.0000   130.0000   100.0000
  1500.0000  2200.0000  1900.0000

T389XE5
     0.0000  4500.0000  3900.0000  3900.0000  4100.0000  4500.0000
  1140.0000  1640.0000  3700.0000   900.0000  1200.0000   900.0000
  4300.0000  1500.0000  1300.0000  2100.0000  2600.0000  2700.0000
  7200.0000  5100.0000  7000.0000

T390XE4
   600.0000   680.0000   510.0000   560.0000   720.0000   770.0000
   100.0000   310.0000   340.0000   220.0000   220.0000   230.0000
   240.0000   390.0000   420.0000   460.0000   500.0000   430.0000
   930.0000   930.0000  1100.0000

T393XE5
  5000.0000  5600.0000  4800.0000  4800.0000  5900.0000  5200.0000
  6000.0000  2400.0000  2500.0000  2500.0000  1300.0000  2000.0000
  1900.0000  2300.0000  2400.0000  3300.0000  4200.0000  3100.0000
  3900.0000  7200.0000  8500.0000

T430XE5
  5500.0000  5200.0000  4900.0000  4900.0000  5000.0000  4800.0000
  1300.0000  1800.0000  2000.0000  1200.0000  1500.0000  1700.0000
  2400.0000  2100.0000  2300.0000  2500.0000  2400.0000  2400.0000
  5300.0000  6300.0000  8500.0000
```